

THE MEMBRACIDAE OF KARTABO¹
BARTICA DISTRICT, BRITISH GUIANA.

WITH DESCRIPTIONS OF NEW SPECIES AND
BIONOMICAL NOTES.

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(Fig. 23; Plates I–VI incl.)

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INTRODUCTION.

In 1922, by the courtesy of the Director, Mr. William Beebe, I spent five months at the Tropical Research Station of the New York Zoological Society at Kartabo, on the Mazaruni River, in British Guiana, and during that time, I made some studies of the Membracidae of the district.

The collecting area, which was confined chiefly to a distance of two miles inland from Kartabo Point, included cassava plantations and clearings, mangrove swamp and forest. Most of the forms described here were taken by myself; but a few species, previously obtained at the Station, have been included. These are marked in the following pages with an asterisk. The determination of certain examples presented difficulties, as the types of the older writers were not always available, and I have been obliged sometimes to rely upon the identifications of others in the collections of the British Museum and of Oxford.

The types of the new species described here are in the British Museum of Natural History.

¹ Contribution, Department of Tropical Research No. 192.

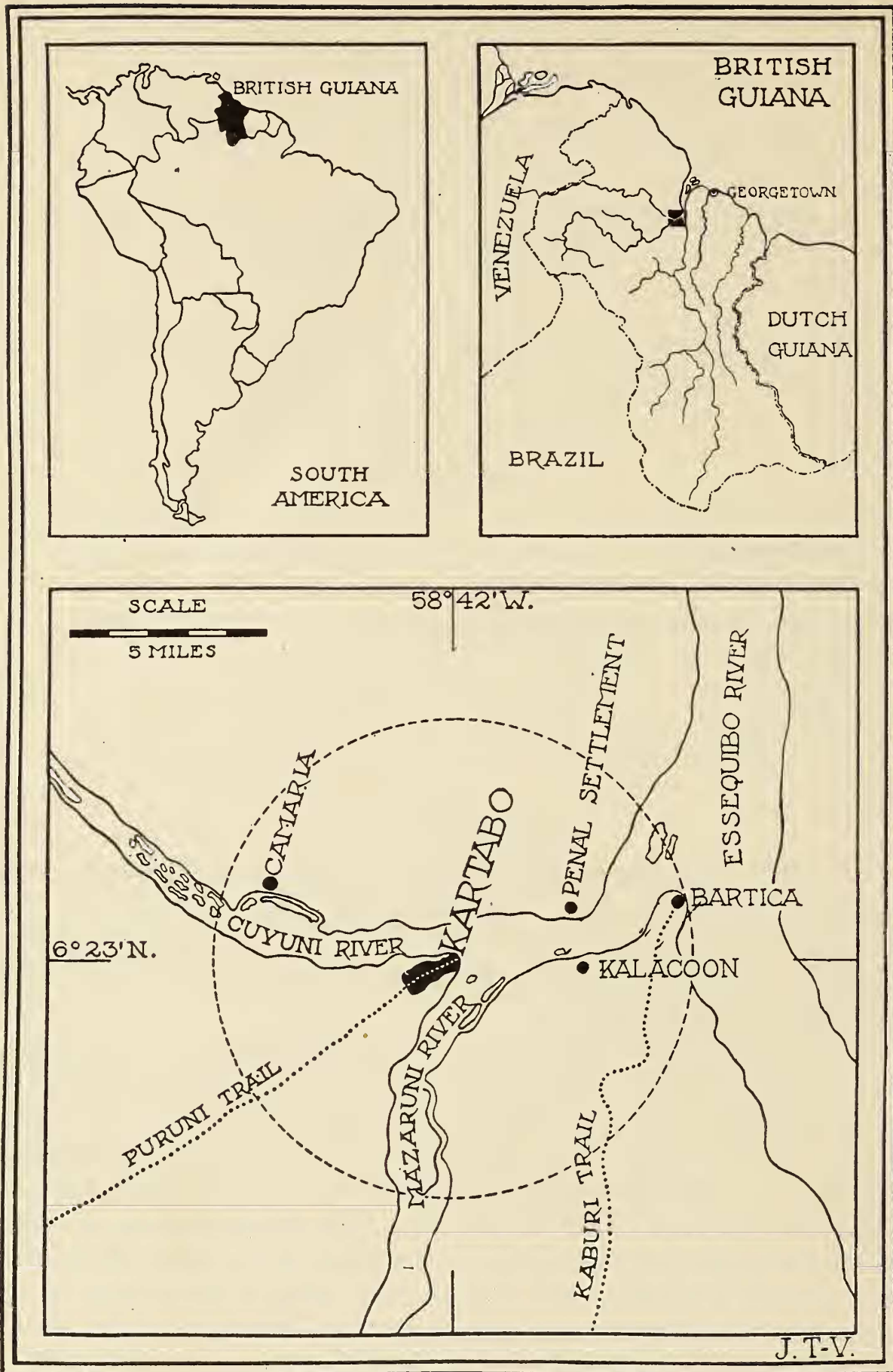


Plate A. British Guiana Tropical Research Station of the New York Zoological Society. Circle represents a radius of six miles.

The synonymy of each species makes no pretension to completeness, but indicates merely where an earlier description can be found.

My thanks are especially due to the Royal Society for a grant enabling me to visit South America; to the authorities of Newnham College for leave of absence during the last three months tenure of my Fellowship; and to Mr. William Beebe for permission to work at the Station, and for much kindness during my stay there.

I must also express my obligations to Mr. Funkhouser of the University of Kentucky, who has examined many specimens for me and compared them with the types of neotropical Membracidae in his collection; and to Dr. Hugh Scott of the University of Cambridge (England) who has given me much valuable assistance on taxonomical points while writing this paper.

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LIST OF SPECIES

Found at Kartabo Point, Bartica District,
British Guiana

Membracis arcuata (Oliv.).

Membracis arcuata, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 247, 1846.

In the nymphal stages, this species is gregarious, and resembles *M. tectigera*, *M. c-album*, etc. The adult is often solitary, and is rather sedentary, feeding on the young shoots of low shrubs in light trails and clearings.

Membracis c-album Fairm.

Membracis c-album, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 244, 1846.

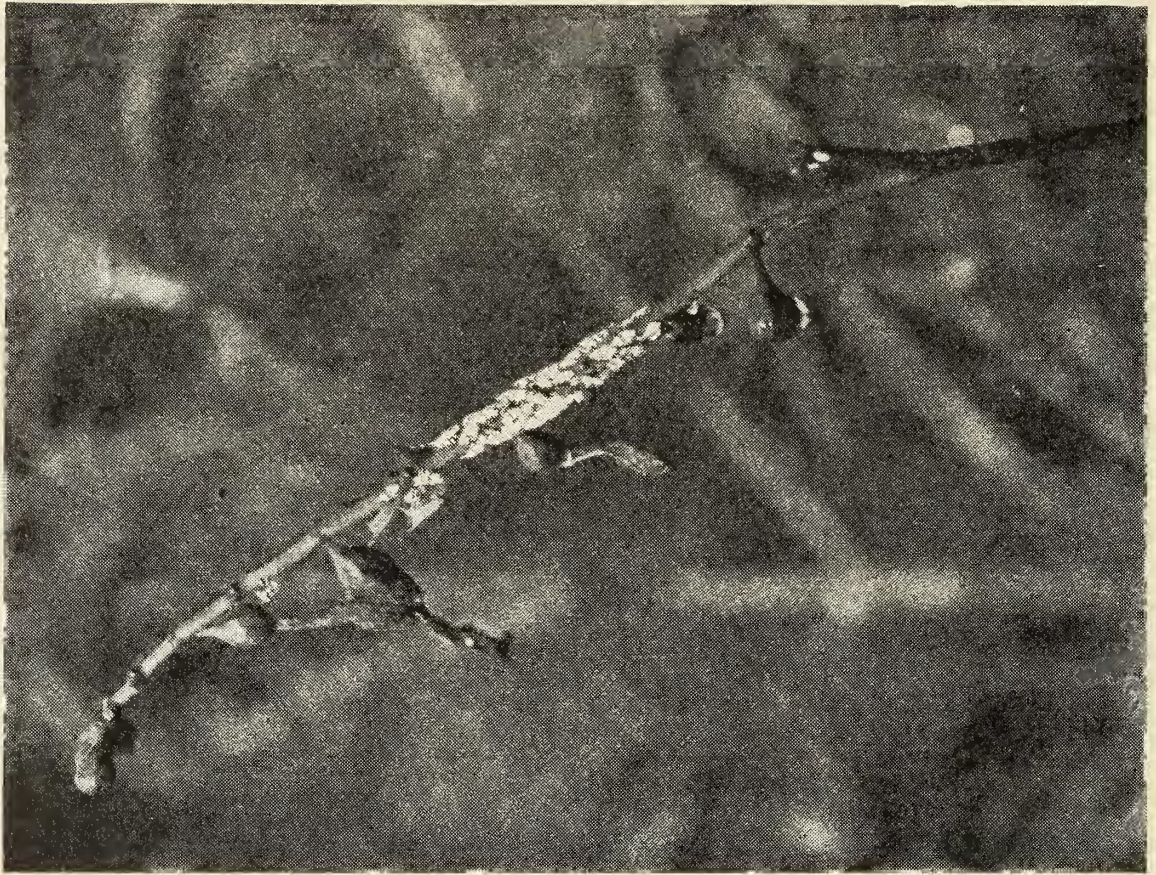
(Pl. VI, fig. 9, nymph.)

This species appeared from time to time between June and September, and is apparently gregarious at all stages. Colonies of the adults and mealy white nymphs occur on the twigs of trees and shrubs of various kinds in open places. The adults are rather sluggish, and when disturbed soon return to their original position.

Membracis carinata (Fabr.).

Membracis carinata, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 244, 1846.

One example (female) taken 6-IX-1922, on low foliage in an open place in the forest.



a



b

Fig. 23.—a, Colony of *Enchenopa lanceolata*; b, Nymphs of *Membracis tectigera* on *Vismia ferruginea*.

Membracis fasciata (Fabr.).

Membracis fasciata, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 245, 1846.

One male, collected at the Station, 3-I-21.

Membracis fusca de Geer.

Membracis fusca, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 244, 1846.

A few examples were taken early in June, in the middle of the rainy season, after which no more were obtained until September, when they appeared in numbers on a flowering tree which provided several other species of *Membracidae*. The form of the nymphs and general habits resemble those of *M. c-album*, and *M. tectigera*. There is considerable variation in size, but this does not appear to be altogether a sexual character.

Membracis humilis Fowler, var.

Membracis humilis, Fowler, *B.C.A., Homop.*, II, p. 6, 1909.

One female specimen (no date) collected at the Station. The white fascia on the metopidium is absent.

Membracis tectigera (Oliv.).

Membracis tectigera, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 246, 1846.

Common from June to September on trees and shrubs in open places, and resembling *M. c-album* in its mealy young, and gregarious habits at all stages. One example was taken from the web of a spider. The males are considerably smaller than the females, but the latter vary a good deal in size, and many are not larger than the males. A variety taken at the Penal Settlement in 1917 is pale fawn colour, and lacks the white band on the metopidium.

Enchenopa albidorsa (Fairm.).

Enchenopa albidorsa, Walker, *List Homopt. Ins. Brit. Mus.*, p. 481, 1850.

Three females taken at the end of July, in the shade of the forest.

Enchenopa bifenestrata Funkh.

Enchenopa bifenestrata, Funkhouser, *Journ. N. Y. Ent. Soc.*, XXX, No. 1, p. 1, 1922.

(Pl. I, fig. 4, eggs. Pl. VI, fig. 2, nymph.)

I am indebted to Mr. Funkhouser for determining this species by comparison with his types.

It was a small, inconspicuous form, common on the twigs of *Vismia* and other woody plants in the clearings. The egg-cases are flat, brown, scale-like objects. (Pl. I, fig. 4.) Oviposition took from one to three days, and the female frequently remained seated upon the eggs after the process was completed. This species was social, and often occurred in company with *Tragopa* and *Horiola* spp., sharing with them the visits of ants.

Enchenopa lanceolata (Fabr.).

Enchenopa lanceolata, Walker, *List Homop. Ins. Brit. Mus.*, p. 481, 1850.

This species was common on the bank of the river near the Station, but seemed to be confined to one host plant, a herb of the order Scrophulaceae with

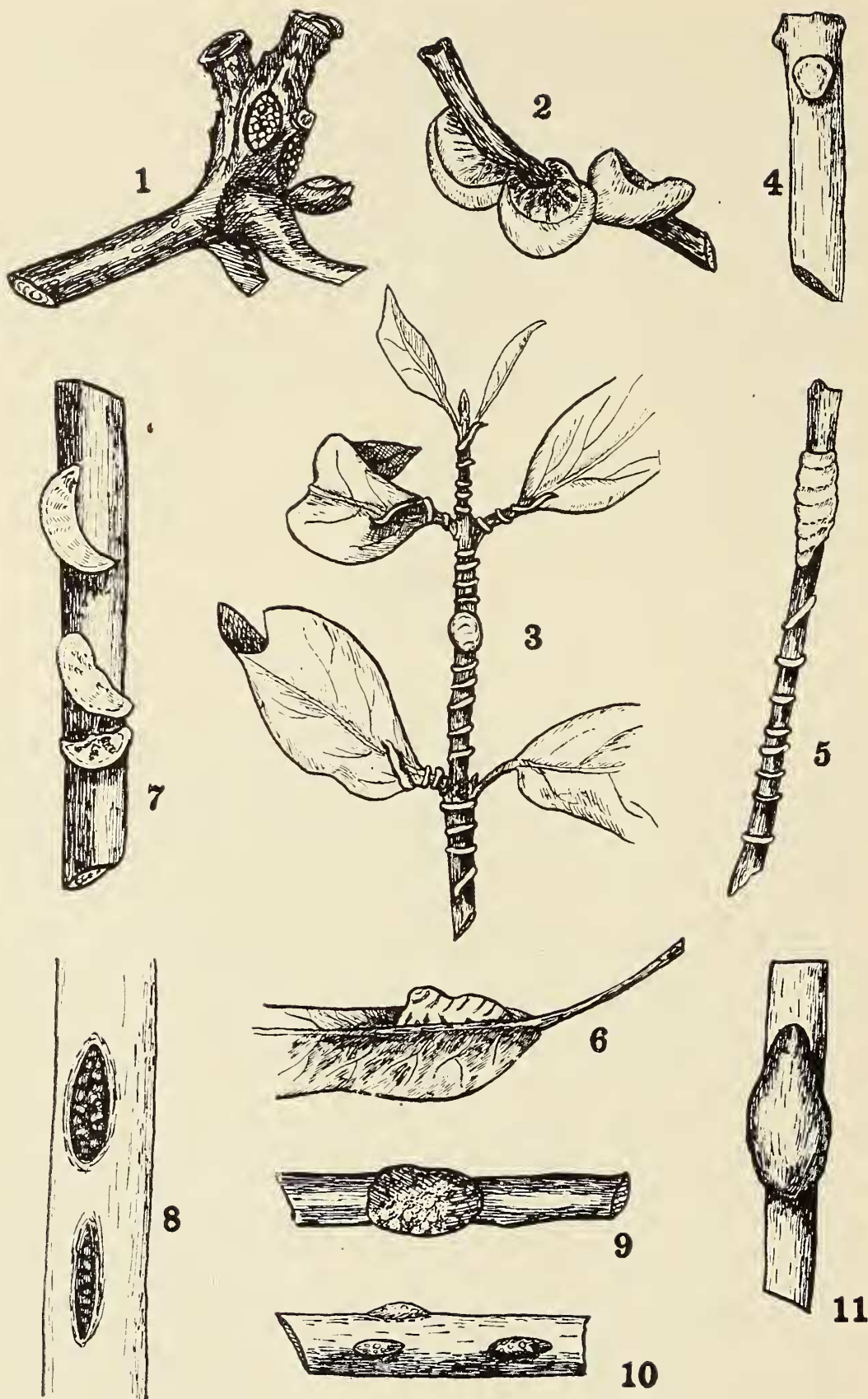


Plate I.—Egg-clusters of, 1, *Tropidocyta gibbosa*, de Geer.; 2, *T. bulbosa*; 3, *T. pruinosa*; 4, *Enchenopa bifenestrata*, Funkh.; 5, *Leioscyta spiralis*; 6, *Campylenchia nutans*, Germ.; 7, *Bolbonota aspidistrae*; 8, *Endoiastus productus*, Osborn; 9, *Aconophora compressa*, Walk.; 10, *Lophyraspis armata*; 11, *Aethalion reticulata*, Linn.

large, greenish-white flowers. The eggs of the Membracids were laid in masses of twenty to twenty-five together in punctures in the epidermis of the stem, and were covered externally with a glistening, white deposit of froth-like wax. The adults did not remain upon the eggs, as is the habit of *Enchenopa bifenestrata* and others of the genus. The eggs hatched in five to six days. The nymphs were white and mealy at every stage, unlike those of the northern form, *E. binotata* Say, which, according to Matusch (Journ. N. Y. Ent. Soc., XX, no. 1, 1912) lose the white coat after the second moult. They were plentifully attended by ants, in this respect again differing from the allied form (Funkhouser, Journ. Econ. Ent., 8, June, 1915). I made considerable collections and records of the development of this species, but my observations as to the number and form of the different instars agree so nearly with what has been written by the authors just cited that it is unnecessary to include them here. The duration of the nymphal stages is discussed elsewhere in a more general connection. The last ecdysis is very striking. The skin splits longitudinally along the dorsum, and the perfect insect, soft and pale, creeps out, leaving the moulted skin attached to the stem by the fore-legs. At first the anterior and posterior processes of the pronotum are equal in size, their axes lying parallel to the long axes of the body; but within seven to ten minutes, literally under one's eyes, the frontal horn elongates, erects itself, and takes on the distinctive form and curvature of the adult, although it requires another two hours or so for the chitin to become black and hard.

Enchenopa monoceros (Germ.).

Enchenopa monoceros, Amyot et Serville, *Hemip. Hist. Nat. Ins.*, p. 535, 1843.

Four females taken together on the flowering twigs of a leguminaceous tree in a clearing, August 8, 1922.

These examples vary considerably in depth of colour.

Enchenopa pulchella Funkh.

Enchenopa pulchella Funkhouser, *Journ. N. Y. Ent. Soc.*, No. 1, p. 2, 1922.

Four examples taken in August, all obtained by sweeping in the low herbage of a cassava clearing near the Station.

One of these (female) has the pronotum unicolorous golden orange, with a black-edged dorsal carina.

Campylenchia nutans (Germ.).

Enchenopa (Campylenchia) nutans, Fowler, *B.C.A., Homopt.*, II, p. 12, 1909.

(Pl. I, fig. 6, eggs. Pl. VI, fig. 3, nymph.)

This form was taken sparingly in June, on a small straggling tree with reddish bark which was common in clearings near the Station. The egg-masses, on which the females remained seated, were elliptical waxy bodies, deposited on twigs and on the under sides of leaves. The species was attended by ants. The horn varies considerably in size and curvature, but this is not apparently a sexual character. The nymphs are a bright chestnut brown, furnished on the dorsum with two pairs of long, black, divergent spines. The extremity of the

anal tube is provided with a pair of even longer spines, which project outwards at right angles to the long axis of the body. I can throw no light on the function of these curious appendages.

Tropidocyta bulbosa, sp. nov.

(Pl. I, fig. 2, Pl. II, fig. 3, Pl. VI, fig. 8.)

Head sooty brown, clothed with thick yellow pubescence, much longer than wide; margins of genae foliaceous; clypeus spatulate, margin somewhat foliaceous, rounded at the apex; eyes brown; ocelli yellow, small, nearer to each other than to eyes, and situated on a level with the upper margins of the eyes.

Pronotum pitchy brown, thickly covered with yellow pubescence; convex in front, not produced into an eminence or horn; humeral angles sub-triangular, blunt; a transverse sulcus above each eye; median carina strongly percurrent; on either side a well-marked lateral ridge extends from the apex of the metopidium over the shoulders to the middle of the posterior process where it terminates in a shallow depression, and another slight depression lies behind the shoulders; posterior process acute, tectiform, not reaching to the tip of abdomen.

Tegmina opaque, brown, sub-hyaline at the apex; veins brown, broad and very hirsute; three discoidal cells.

Underparts and legs pitchy brown; hind tibiae strongly spined; tarsi yellow. Long. 3.0 mm. Lat. 1.75 mm.

Type: Female. Sexes alike.

This species is allied to *T. minuta* Funkh., but Mr. Funkhouser, who has compared examples from Kartabo with the types in his possession, considers it distinct.

T. bulbosa is a small, dark, globose insect, which in the field has the facies and habits of a Bolbonota. It was taken in June and July on foliage in the trails in company with *B. aspidistrae* and the eggs were found in July on the twigs of a flowering shrub in a clearing near the Station. The egg masses are of the same type as those of *B. aspidistrae*, but are thicker, whiter and more definitely cup-shaped.

Under the microscope, this nest is a beautiful object, and is very large for the size of the insect. The eggs, to the number of twelve to fifteen, lie in the plane of the long axis of the parent's body, and are arranged radially in a semi-circle. The colleterial secretion issues in the form of a lustrous white thread of waxy material, which is wound and piled around and over the eggs in an elaborate manner to form a cup in which the female sits, freely attended by ants. These egg-masses sometimes occur singly, but more often in clusters, and formed quite conspicuous objects against the dark bark.

Two females and a male of the series differ somewhat from the description given above, without meriting specific rank. They are smaller (Long. 2.5 mm.; Lat. 1.5 mm.) and darker in colour. The median carina is ferruginous, and an additional small carina extends over the shoulder. The tegmina are dark and less hairy than in the type form; the apical areas are clear hyaline, and there is a conspicuous clear spot at the apex of the clavus.

Tropidocyta gibbosa (de Geer).*Cicada gibbosa* de Geer, *Mem. V.*, p. 211, 1775.*Membracis bicristata* Fairmaire, *Ann. Soc. Ent. Fr.* 2, IV, p. 256, 1846.*Tropidocyta gibbosa*, Stal, *K. Sven. Vet-Akad. Handl.* 8, p. 45, 1869.? *Tropidocyta albipes* Funkhouser, *Journ. N. Y. Ent. Soc.*, XXX, no. 1, p. 4, 1922.

(Pl I, fig. 1, eggs.)

The figures and descriptions of de Geer and Fairmaire leave little doubt that this is the form whose synonymy is given above.

This species is of interest as being the only Membracid in the collection from Kartabo which invariably caused a definite local deformity of the host plant. It was found in August, in dark places in the forest, on a certain straggling shrub with waxy pink flowers which were borne in a loose inflorescence. While still in bud, this inflorescence was attacked by *T. gibbosa*. It became distorted and lignified; and the bud that it bore shrivelled and fell off. The eggs in masses of forty to fifty together were laid on this deformed stump. The adults and nymphs, attended by ants, clustered upon it and were never observed to feed on any other part of the plant.

***Tropidocyta neglecta*, sp. nov.**

(Pl. II, fig. 4.)

Head pitchy black, thickly beset with golden pubescence, longer than wide; margins of genae sinuate, acutely lobed at the apex; clypeus sub-triangular, foliaceous, projecting for more than half its length beyond genae; eyes brown; ocelli yellow, small, inconspicuous, twice as far from one another as from eyes, and situated on a level with the upper margins of the eyes.

Pronotum dark ferruginous brown, roughly sculptured, pubescent, not punctate, sub-angulate in front, not produced into a horn. Metopidium about as wide as high, furnished with a strong percurrent carina which is ferruginous brown, high and sharp; posterior process acuminate, somewhat compressed laterally at two points behind the middle, slightly depressed at the apex, not reaching tips of tegmina; on either side a strong lateral carina extends obliquely over the shoulder to the margin behind the base of the tegmen.

Tegmina brown, opaque, punctate at the base, paler at the apex; veins very pubescent; three discoidal cells.

Long. 4.5 mm. Lat. 2.0 mm.

Type: Female.

One example taken on *Vismia ferruginea* by sweeping, 2-IX-22.***Tropidocyta pruinosa*, sp. nov.**

(Pl. I, fig. 3; Pl. II, fig. 5.)

Dark purplish brown, punctate; head, prothorax and underparts thickly clothed with silvery pubescence, which gives the insect a frosted bloom.

Head about as long as wide; margins of genae semi-foliaceous, lobed; clypeus foliaceous, broad and rounded at the apex, which projects considerably beyond

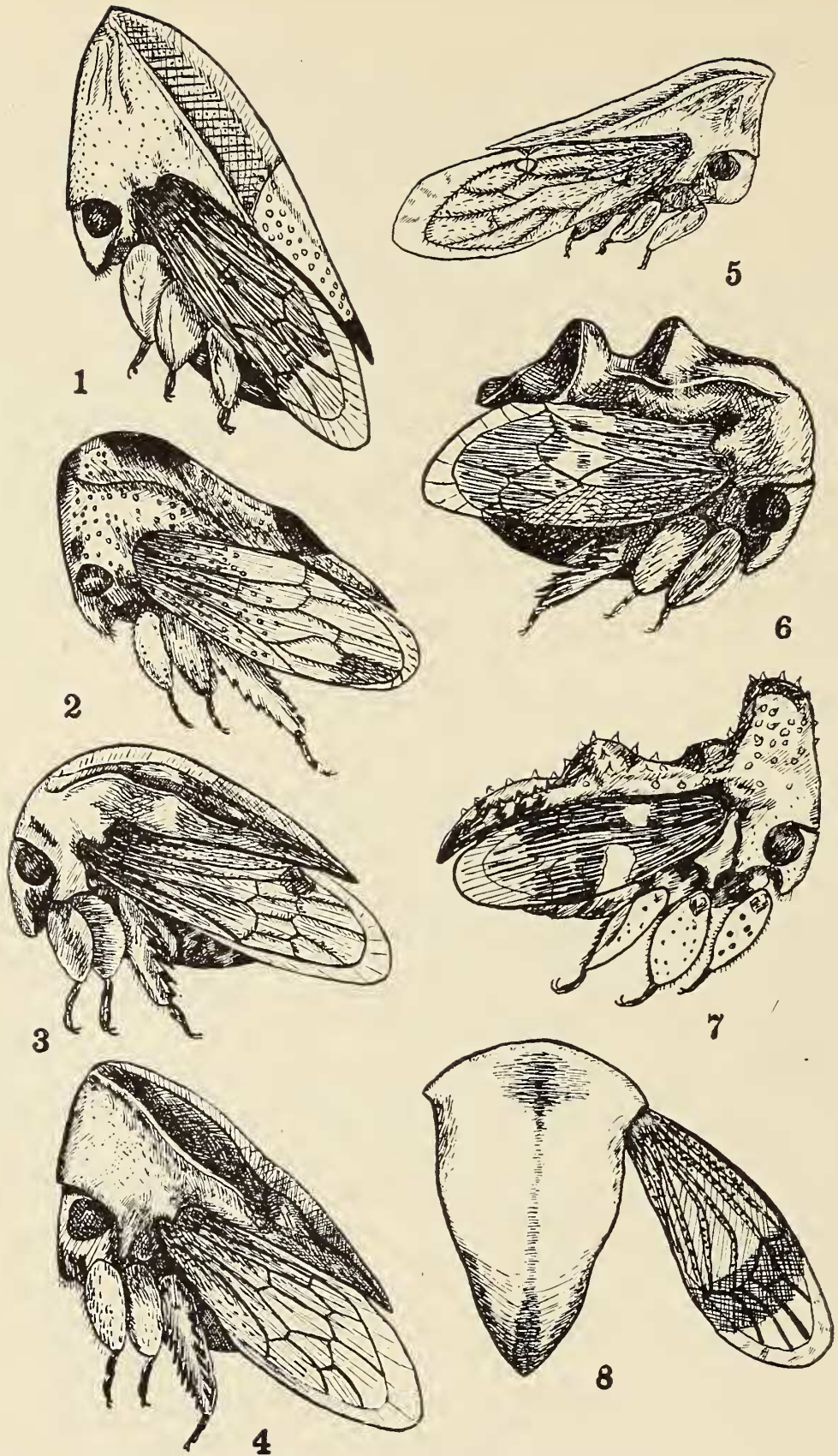


Plate II.—1, *Leioscyta beebey*; 2, *L. spiralis*; 3, *Tropidocyta bulbosa*; 4, *T. neglecta*; 5, *T. pruinosa*; 6, *Bolbonota aspidistrae*; 7, *Hypsoprora aspera*; 8, *Rhexia kartabensis*.

margins of genae; eyes yellowish grey, rather prominent; ocelli amber colored, nearer to the eyes than to the median line, and situated on a level with the centres of eyes.

Prothorax furnished with a very short, conical, blunt horn slightly recurved at the apex; anterior border straight; metopidium traversed by a faint, median ridge; humeral angles rounded, not prominent; posterior process narrow, acuminate, just reaching the tip of abdomen, and furnished with a sharp, per-current carina; a pair of lateral carinae on each side, the superior, which is sharp and strongly marked, extends from the tip of the frontal horn to the margin of the posterior process, half way to the apex, the inferior is less pronounced and extends from the metopidium to the humeral angles; edges of the carina black, the intervening spaces heavily clad with white pubescence; tegmina entirely free, brown, opaque, and with a velvety bloom; a small sub-hyaline spot at the base of the internal apical cell; veins very broad, raised, and together with the basal areas of the corium and clavus, clothed with white, silky hairs; one discoidal and five oblong, narrow, straight, apical areas.

Legs pale, sordid yellow; tibiae scarcely foliaceous, the hind pair furnished with row of spines; tarsi tipped with black.

Long. 5.4 mm.

Lat. 2.0 mm.

Tegmen: 5.0 mm.

Type: Female.

This species is very distinct. It has the facies of a *Tropidocyta*, and in spite of the non-foliaceous legs and the single discoidal cell, should probably be placed in this genus, for the venation is obscure, and as the description is based on a single example, the disappearance of a cross vein may be an individual abnormality.

This species was rare at Kartabo. In the beginning of June, my attention was attracted by white, spiral threads of some viscous or waxy substance, twined round the twigs of shrubs, five or six feet above the ground; but it was not until the 26th of the month that I recognized these as the unfinished nurseries of this Membracid. The thread is wound many times above and below the egg-case, which is a lenticular, glistening, white body, in which the eggs are embedded. The female sitting upon this egg-mass was not attended by ants. The purpose of the thread is not known. It may be a protection against predatory enemies, but after removal of the female, I kept the nest under observation for some time, and on the following day found that it was invaded by ants, although the thread was intact. The egg-case gradually disintegrated; only two nymphs were hatched, and these disappeared a day or two later.

The number of nests of this elaborate plan that were left uncompleted is striking; for early in July, I found two more, but neither searching nor sweeping produced another example of the Membracid.

***Leioscyta beebei*, sp. nov.**

(Pl. II, fig. I.)

Head ochreous, shaded with dark brown; margins of genae arcuate and acutely lobed below; clypeus lobed at its articulation with genae, and with the free margin foliaceous and broadly rounded; eyes grey; ocelli yellow, equidistant between the eyes and the median line, and situated just above the level of the centres of the eyes.

Pronotum testaceous yellow, punctured densely in front and more coarsely behind, obtusely angular, not horned at the frontal apex; metopidium high, perpendicular, furnished with a carina which is strong and percurrent on the dorsum; humeral angles not prominent; a strong lateral carina on either side extending from the metopidium to the pronotal margin half-way to the apex of the posterior process; three, faintly marked ridges on either side of the metopidium, below and in front of the lateral carina; posterior process acuminate, not quite reaching tip of abdomen, white, black at the apex, and furnished with a bright, chestnut spot on the dorsum between the lateral carinae.

Tegmina chocolate, with a yellow, sub-hyaline patch at the apex. Abdomen, underparts and legs ferruginous black; tarsi yellow.

Long. 5.0 mm.

Lat. 2.0 mm.

Tegmen: 4.25 mm.

Type: Female.

Sexes alike.

A male and female collected at the Station 29-X-20.

I have much pleasure in naming this species after Mr. William Beebe, Director of the Tropical Research Station at Kartabo.

Leioscyta spiralis, sp. nov.

(Pl. I, fig. 5, Pl. II, fig. 2.)

Head ochreous brown, finely punctate, clothed with silky white pubescence, longer than wide; margins of genae foliaceous; clypeus foliaceous, rounded laterally, and with the apex truncate; eyes brown; ocelli yellow, rather large, nearer to the eyes than to one another, and situated on a level with the upper margins of the eyes. Pronotum sordid ochre, clouded with umber brown, paler behind, punctate, pubescent; metopidium carinate, sloping, rounded at the summit, not furnished with an eminence or horn; humeral angles sub-triangular, not produced; posterior process roughly sculptured, coarsely punctate, very acute, just reaching to the tip of the abdomen; median carina high, sharp, and percurrent; on either side, a strong curved lateral carina extending from the summit of the metopidium over the shoulders to the lateral margin of the posterior process, two large spots on the dorsum and the apex of the posterior process, chocolate brown.

Tegmina brown, coriaceous and opaque at the base, and with a dark spot at the apex; veins pale brown, broad and hirsute.

Underparts dark brown, pubescent; tibiae sordid yellow.

Long. 6.0 mm.

Lat. 3.5 mm.

Length of Tegmen: 6.0 mm.

Type: Female.

This species resembles the type of *Enchenopa quadricolor* Walk. in the British Museum, but differs in the stouter form and position and curve of the lateral carinae. This, the only example obtained, was taken from a curious egg-mass of the type of that of *Tropidocyta pruinos*a. The eggs themselves were embedded in an imbricated, brown, waxy mass, and the twig below was encircled about a dozen times with a white viscous thread. During the time that the nest was under observation, it was not visited by ants, but I found by experiment that the thread was no bar to these insects, which were running in numbers over the tree.

***Bolbonota aspidistrae*, sp. nov.**

(Pl. I, fig. 7, Pl. II, fig. 6, Pl. VI, fig. 1.)

Head black, with golden pubescence, much longer than wide; genae acutely lobed at the apex; clypeus foliaceous, lozenge-shaped, with angles sub-acute; base of head convex and rather prominent; eyes dark brown; ocelli translucent, twice as close to eyes as to each other, and situated on a level with upper margins of eyes.

Prothorax bronze black, pubescent, punctate, highest between shoulders, with humeral angles conical, blunt and prominent; dorsum furnished with two tubercles of equal size; the anterior conical, and not laterally extended; the posterior strongly carinated and extended transversely to the lateral margins of the pronotum. A percurrent, median carina extends over the metopidium and tubercles to the apex of the posterior process, which is sub-acute, roughly sculptured and not especially depressed. A strong, semicircular, lateral carina extends backwards from the metopidium on each side of the anterior tubercle.

This species is variable in colour. In some examples the whole insect is deep, sooty black, and the tegmina are black and opaque, occasionally spotted with white, and hyaline at the apex. In others, the genae and clypeus are bordered with ochreous; the prothorax and abdomen are ferruginous; the dorsum, including the carina, tubercles and apex, and the legs are ochreous yellow. In such a case the tegmina are ferruginous, marked conspicuously with white and yellow.

Long. 3.0 mm. Lat. 2.0 mm.

Type: Female. Sexes alike.

This species, like *B. corrugata*, *B. inaequalis* and *B. pictipennis*, was common in the more open, forest trails on the upper surface of leaves of *Aspidistra* and other plants. All these forms readily take wing, but are otherwise well protected, owing to their resemblance to small pieces of bark and withered buds which fall in profusion from the foliage overhead.

In July, I found a small colony breeding on a shrub beside a trail. The nests are crescentic, white structures, hollow above, and usually placed two or three together at the base of a petiole. The female sits in the concavity until the brood is hatched, unless accidentally disturbed, and if she departs, she does not find her way back again. The nymphs are dull green and active. Soon after hatching, they crawl up the stem and feed on the under side of the leaves on the mid-rib. The nesting females and nymphs are visited by swarms of ants, which muster to the attack if the plant is shaken, but the free-living adult Membracids, probably owing to their restless habits, are never thus attended.

A small series in the Hope Museum at Oxford is labelled in Canon Fowler's handwriting as *Tylopetta gibbifera* Stal. It is undoubtedly near to *B. aspidistrae*, from which it differs in its smaller, more elongate form, and in the less prominent humeral angles and carinae. I am unable to trace this species unless it is identical with *Tropidocyta gibbera* Stal. which Fowler (*B.C.A.*, p. 15) removed to his new genus *Tylopetta*, but it does not altogether correspond with the descriptions of that form.

Bolbonota corrugata Fowler.

Bolbonota corrugata Fowler, *B.C.A., Homopt.* II, p. 19, 1909.

Two examples among a series of *B. aspidistrae* obtained in the forest, June 26th, 1922.

Bolbonota inaequalis (Fabr.).

Bolbonota inaequalis, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 259, 1846.

Two females taken by sweeping in the forest, June 14th, 1922, and a third, and two nymphs of the last instar, obtained on a twig in rather a dark place in the forest, July 1st, 1922. The nymphs were covered with mealy white powder, and were attended by ants.

Bolbonota pictipennis Fairmaire.

Bolbonota pictipennis Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 258, 1846.

One female taken by sweeping in the forest, Sept. 22nd, 1922, and determined by comparison with the series in the British Museum.

Pterygia uropygii Buckt.

Pterygia uropygii Buckton, *Monograph of the Membracidae*, p. 72, 1903.

One female was taken on leaves in the forest, July 24th, 1922.

This remarkable form is a very beautiful object under low power of the microscope, the spines along the dorsum and lateral horns being touched with purplish pink.

Stoll figures what is evidently meant for this species (Cic., fig. 8) under the title "Het Kruis," or "The Cross."

Sphongophorus guerini Fairmaire.

Sphongophorus guerini Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 262, 1846.

This species was solitary, and not uncommon on shrubs and low foliage in the clearings. It was rather sluggish, and could easily be caught by hand. According to my observations, it was never attended by ants.

***Hypsoprora aspera*, sp. nov.**

(Pl. II, fig. 7.)

Head covered with white encrustation, punctured with black, rather longer than wide; margins of genae straight, acutely lobed at apices; clypeus extending far below genae, spatulate, with the free margin slightly rounded and pilose; eyes grey and prominent; ocelli grey, twice as far from each other as from eyes, and situated on a level with the upper margins of the eyes.

Prothorax rugose, black, profusely decorated with white, punctured and studded with small spines; furnished with a stout, erect, frontal horn, which is truncated, not compressed, and carinated at the apex; posterior process long, carinate, much compressed laterally, with the apex blunt and decurved, reaching the tips of the tegmina; dorsum provided with two tubercles, a small one at the base of the frontal horn, and a large, rounded protuberance behind it. On either side of the latter is a strong, lateral ridge, which extends to the apex of the posterior process.

Tegmina chocolate brown, black and punctate at the base and decorated with white patches on the claval and costal margins; venation somewhat obscured.

Abdomen and underparts black, decorated with white; femora and tarsi black; tibiae very foliaceous, white and punctate.

Long. 5.50 mm. Lat. 2.50 mm. Alt.: 3.50 mm.

Type: Female.

This form is very close to *Hypsoprora (Pterygia) pileata*, Fairm.

A single example was taken by sweeping in a clearing, July 23rd, 1922.

Aconophoroides gladiator (Walk.).

Aconophoroides gladiator, Fowler, B.C.A., *Homopt.*, II, p. 48, 1909.

This species seemed rather scarce at Kartabo. Three examples were taken at the beginning of June, and another male in September, in every case on the reddish bark of a shrub of species undetermined.

On one occasion a specimen had just been captured by a spider.

The horn of the male is much shorter than that of the female, and may be almost obsolete.

* *Umbonia spinosa* (Fabr.).

Umbonia spinosa, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 276, 1846.

Four specimens taken at the Station, August 16th, 1922.

Darnis latior Fowler.

Darnis latior Fowler, B.C.A., *Homopt.*, II, p. 52, 1909.

Single individuals were found occasionally in the darker parts of the forest, feeding in the axils of the leaves of herbaceous plants.

Darnis partita Walk.

Darnis partita Walker, *Ins. Saunders.*, *Homopt.*, p. 75, 1850.

More common than the last, and fed in the axils of leaves, in lighter parts of the forest. Usually it occurred singly, but occasionally two individuals were found together.

Stictopelta indeterminata (Walk.).

Stictopelta indeterminata, Fowler, B.C.A., *Homopt.*, II, p. 59, 1909.

Three specimens collected at the Station, July 21st, 1922, evidently belong to this species, which, following Fowler, I have included in the genus *Stictopelta*. I am, however, inclined to think that it would be more properly placed in Fowler's own genus, *Hebeticoides*, for the distinguishing characteristics, the contiguity and position of the bifurcation of the ulnar veins, are variable even in the small series of examples that I have had for comparison.

Aconophora compressa Walk.

Aconophora compressa Walker, *List. Homopt. Ins. Brit. Mus.*, p. 541, 1850.

(Pl. I, fig. 9, eggs.)

Taken in July and later in August and September, on the stems of a shrub in a shady place. The adults readily take wing, but soon return to their original

position. The egg-cases are brown, elliptical bodies, each containing a score or more eggs, which are embedded in the waxy substance of the case and not inserted in the tissues of the plant. Each female remains seated on her eggs unless disturbed. The long frontal horn appears remarkably like a thorn or broken twig when the insect is seen thus *in situ*, and this character is also well marked in the nymphs. It is of course relatively little developed in the early instars, which are dingy ochreous and black forms; but already by the fourth instar the frontal horn and dorsum are conspicuously marked with bright, ferruginous brown, and the sides of the body are decorated with white, flocculent patches. The nymph of the fifth instar is much more gaily coloured than the adult. The head, wing-cases and underparts are black; the pronotum is bright chestnut, marked heavily along the sides with black, and with a black stripe down the carinated metopidium. The rest of the thorax and abdomen are black, conspicuously variegated with yellow and white, and the legs are black with yellow femora.

The nymphs of every stage are furnished with four pairs of long, black, dorsal spines; the first, on the mesonotum, are somewhat recurved, and project back on either side of the posterior process. The remaining pairs are on the first, second and third abdominal segments. At all stages the nymphs are active and run rapidly down the stem when disturbed. Their long, red-tipped horns give them the semblance of a row of thorns, although the plant on which they were found in this instance is not thorny. They excrete large quantities of "honey-dew," which smears the surrounding foliage, and attracts many ants.

Cymbomorpha vaginata (Germ.).

Cymbomorpha vaginata Stal, *K. Sven. Vet-Akad. Handl.* 8, 1, p. 34, 1869.

Two females, dated the 15th and 22nd of July, 1922. One had been carried off by a hunting spider.

***Rhexia kartabensis*, sp. nov.**

(Pl. II, fig. 8.)

Head pale green, shining, punctate, sub-triangular, broader than long; genae straight; clypeus small, rounded, hairy at apex, not produced beyond margins of genae; eyes red, prominent; ocelli yellow, twice as far from each other as from eyes, and situated on a level with the upper margins of eyes.

Pronotum pale translucent green, shining, very finely punctured, convex, highest above shoulders, non-carinate; metopidium sloping, twice as wide as high; humeral angles blunt, slightly produced; posterior process sub-acute, much compressed behind shoulders, margin sinuate, not quite reaching apex of tegmina; a dark brown median line from metopidium extending along dorsum; lateral margins and apex of posterior process much suffused with olive green.

Tegmina entirely free, yellowish brown, semi-opaque, with a broad dark band across the distal third and hyaline at the apex; veins pale brown, punctate.

Underparts green; legs yellow; hind tibiae with three rows of small black spines.

Long. 6.0 mm. Lat. 4.0 mm.

Type: Female.

One example taken on foliage in a trail, attended by ants, Sept. 4th, 1922.

Heteronotus armatus Lap.*Heteronotus armatus* Laporte, *Ann. Soc. Ent. Fr.*, 1, IV, p. 97, 1832.

(Pl. III, fig. 8.)

The Kartabo series has been identified by comparison with specimens determined by Fowler in the Hope Museum, and also with those in the British Museum. *H. confusus* Butl. is possibly a synonym; and Fairmaire is probably right in supposing that *H. spinosus* Lap. is only a pale form of *H. armatus*.

This fine insect was not uncommon round the Station in August and September, but the nymphs were not found. The adults were solitary, and inhabited the edges of clearings. They sat in full view on the upper side of the foliage, and readily took wing with a loud buzzing noise.

I procured examples of two other forms of this genus allied to *H. armatus*, but which do not correspond to any named specimens or descriptions of species to which I have access. Both were taken in the same surroundings, and have the same general facies and habits as *H. armatus*. It is probable that many of the described forms of this type will prove to be varieties of a single species. At present the difficulty of determining examples from brief descriptions, often unsupplemented by figures, is very great.

***Heteronotus albospinosus*, sp. nov.**

(Pl. III, fig. 6.)

Head gamboge yellow with two black stripes. Prothorax armed anteriorly with two, long, slender, yellow spines, diverging outwards for the first half of their length and then curved almost to a right angle and directed backwards. Posterior process divided into three nodes or swellings, the first being the smallest, and the second and third nearly equal in size. The third, which is borne at the end of a peduncle equal in length to half the diameter of the node, is furnished with one ventral and two dorso-lateral, slender, backwardly-directed spines. Pronotum ochre yellow, bordered with cream colour. On either side of the metopidium, a black stripe, continuous with the facial stripe, extends obliquely to the lateral margin, where it joins a second black stripe rising behind the eye, and reaches the humeral angle; between the anterior spines, a circular black spot, interrupted by a median yellow line; second and third nodes laterally suffused with black. Spines wholly yellow, with the exception of the posterior dorso-lateral pair which are white for the distal third of their length.

Rest of body and limbs yellow. Tegmina hyaline yellow with black veins.

Length of body to end of abdomen 7.5 mm.

Length of body from frons to tip of posterior spines 10.0 mm.

Length of tegmen 8.0 mm.

Width between tips of anterior spines 5.3 mm.

Type: Female.

A specimen in the Hope Museum, collected by Bates on the Amazon in 1861, and labelled "? sp." in Canon Fowler's writing, belongs to this form.

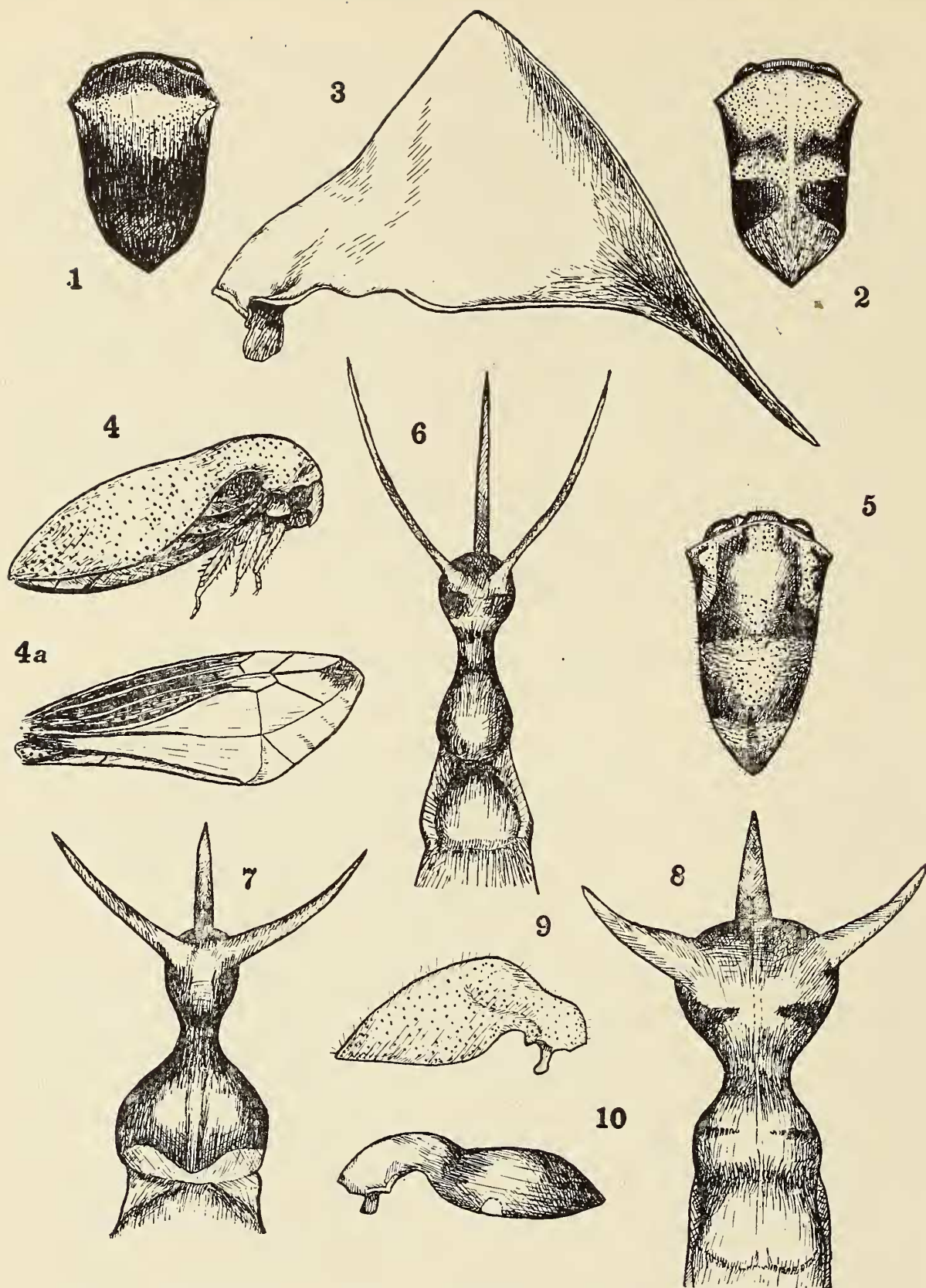


Plate III.—1, *Tragopa occulta*; 2, *T. guianae*; 3, *Telemona spinigera*, prothorax; 4, *Aphetes affinis*; 4a, *A. affinis*, tegmen; 5, *Vanduzea testudinea*; 6, *Heteronotus albospinosus*, posterior process; 7, *H. vespiformis*, posterior process; 8, *H. armarus*, Lap., posterior process; 9, *Amastris funkhousei*, prothorax; 10, *Boethoos globosa*, prothorax.

Heteronotus vespiformes, sp. nov.

(Pl. III, fig. 7.)

This form is close to *H. divisus*, Wlk., but the peduncle of the posterior node is somewhat differently constructed.

Head gamboge yellow with two black stripes.

Pronotum gamboge yellow, decorated with two, broad, black stripes, which are joined by a transverse band at the base of the posterior process, and are interrupted by a large, cuneiform, yellow spot on either side of the metopidium and by a circular, yellow area round the base of the anterior spines, which are black, stout, and directed slightly backwards. Posterior process ochre yellow, with a low tubercle at the base and two nodes; the first large, black, not constricted in front, rounded behind; the second smaller, oval, arising by a short peduncle not equal in length to half the width of the node, heavily marked with black and furnished with one ventral and two dorso-lateral, stout, almost straight and backwardly diverging spines.

Rest of body and legs yellow; tarsi black.

Tegmina yellowish hyaline, shining, with black basal, and brown apical, veins.

Length from frons to tip of abdomen..... 8.0 mm.

Length of tegmen..... 10.0 mm.

Length from frons to tip of posterior spines..... 10.0 mm.

Width between tips of anterior spines..... 6.0 mm.

Type: Female.

Tragopa cimicoides (Fabr.).

Tragopa cimicoides, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 485, 1846.

(Pl. VI, fig. 6, nymph.)

Commonly taken from June to September, and showing considerable variation in the amount of black colour on the pronotum. The eggs were laid in clusters of 30-40, in slits in the epidermis of the stems of various woody plants. The females sat on the eggs, and were much visited by ants. When breeding, they were eminently gregarious, so much so that an infested twig looked as if it were crowded with brown berries, or possibly with galls, though I would not go so far as to suggest cryptic resemblance as an interpretation of the peculiar form. When not breeding, the adults tended to solitary habits, and were frequently taken by sweeping in herbage in the clearings.

Tragopa guianae, sp. nov.

(Pl. III, fig. 2.)

Head pale ochreous, spotted with brown, shining, not punctate, not pubescent, twice as broad as long, margins of genae short, slightly arcuate, lobed at apex; clypeus small, the free margin tri-lobed, hairy at the apex, not projecting beyond margin of genae; eyes grey, prominent, and directed laterally; ocelli yellow, nearer to eyes than to each other, and situated on a level with the centres of eyes. Prothorax dirty white in ground colour, finely and densely punctured with brown, and furnished with short, scattered hairs, shield shaped,

excavated behind shoulders, which are rounded and not prominent; metopodium sloping, very much wider than high; dorsum convex, highest in the middle, non-carinate; posterior process blunt, just covering apex of abdomen and tegmina. A chocolate-brown, irregular, transverse band rising behind the shoulders and extending backwards across the middle of the dorsum; behind this on either side a large sub-triangular brown spot; apex of posterior process brown.

Exposed portions of tegmina bright brown, shining, not punctate. Underparts chocolate-coloured, pubescent; legs yellow; tarsi black.

Long. 3.50 mm.

Lat. (int. hum.) 2.5 mm.

Type: Female.

Two females taken in a colony of *Vanduzea testudinea*, August 2nd, 1922.

The resemblance in colour and pattern between the two forms is so close, that without careful examination, they might be mistaken for varieties of the same species.

***Tragopa occulta*, sp. nov.**

(Pl. III, fig. 1.)

Head black, shining, finely and remotely punctate, half as long as wide; margins of genae arcuate; clypeus small, sub-quadrated, and projecting for about half its length beyond genae; eyes dark brown; ocelli yellow, nearer to eyes than to each other, and situated just above the level of the centres of the eyes.

Prothorax convex, black, shining, finely and thickly punctate, destitute of median line or keel; anterior margin rounded; metopidium sloping, highest above shoulders; humeral angles sub-triangular, only slightly produced; posterior process excavated behind shoulders, apex plicate and sub-acute.

Tegmina with the exposed portion coriaceous, black, and thickly punctate. Underparts and legs rusty black.

Long. 4.50 mm. Lat. 2.75 mm.

Type: Female.

One example taken in deep forest, July 5th, 1922.

This form may prove to be merely a dark variety of some species already known.

Tragopa scutellaris Buckt.

Tragopa scutellaris Buckton, *Monograph of the Membracidae*, p. 156, 1903.

Not uncommon; resembles the last in habits.

Tragopa tripartita Fairm.

Tragopa tripartita, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 490, 1846.

I am indebted to Mr. Funkhouser for determining this most variable form. At first sight the different variations look like distinct species; but the types of colour and patterns imperceptibly grade into one another, and slight differences of size and proportion are not constant and may occur with any colour combination. The variations are not due to sex.

The principal varieties in the Kartabo collection are:

Var. 1. Entirely bronze black.

Var. 2. Head and anterior part of pronotum pale ochreous brown, with a very broad, transverse band, usually black but occasionally chestnut behind the shoulders, and sometimes with the apex of the posterior process black.

Var. 3. Like the last, but with the median band interrupted on the dorsum.

Var. 4. Like the last, but with the transverse band marked with a lateral testaceous spot, and the apex of the posterior process olive-brown.

Var. 5. Pronotum bright reddish brown, obscurely marked behind the shoulders and across the posterior process with darker brown.

This was a common species taken on *Vismia ferruginea* and other plants, frequently in company with *Tragopa cimicoides* and *Horiola arcuata*. The different varieties were found together in the same colonies. They were always visited by ants, which often built shelters of vegetable fibre over and around them.

Horiola arcuata (Fabr.).

Horiola arcuata, Fowler, B.C.A., Homopt., II, p. 86, 909.

A gregarious species which sometimes occurred in considerable numbers, often in association with *Tragopa tripartita* Fairm. It fed on various plants, but especially on the twigs of *Vismia ferruginea*, where it was frequently enclosed in shelters of vegetable fibre which had been built over it by the gnats which always attended it. The eggs were laid in clusters of 30-40 together in slits in the epidermis of the stems.

Horiola ferruginea Fairm.

Horiola ferruginea Fairmaire, Ann. Soc. Ent. Fr., 2, IV, p. 493, 1846.

One male taken in a colony of *H. arcuata*. I believe this to be Fairmaire's species, although the "tres petite ligne blanchatre" at either side of the extremity of the posterior process is replaced in my specimen by a minute white spot.

Boethoos cinctata, sp. nov.

(Pl. IV, fig. 5.)

Head chestnut brown, polished, not punctate, with scattered hairs, surface somewhat irregular, sub-triangular, about as long as wide, projecting forwards; margins of genae oblique, somewhat plicate and extroverted; clypeus small, not extending below genae, tip blunt and thickly hairy; eyes brown, prominent; ocelli yellow, equidistant from each other and from eyes, and situated just below the level of the centres of the eyes.

Pronotum bright chestnut brown, with metallic lustre, punctate, thickly hairy, with a broad transverse gamboge-yellow band over the dorsum behind the shoulders, convex, with the median carina faintly marked; metopodium sloping, wider than high; humeral angles sub-triangular, not much produced; posterior process excavated, and somewhat compressed behind shoulders; lateral margin sinuate; apex rounded.

Tegmina hyaline, with thick dark veins and two infuscated patches at the apex.

Underparts and legs light brown, shining, and rather pubescent.

Long. 7.0 mm.

Lat. 3.5 mm.

Type: Female.

One example collected in a clearing, August 15th, 1922.

A second female in Mr. Beebe's collection, dated July 15th, 1922, is evidently of the same species, but the transverse band is faint sordid yellow.

Boethoos distinguenda Fowler.

Parmula distinguenda Fowler, *B.C.A., Homopt.*, II, p. 91, 1909.

Parmula = *Boethoos*, Kirkaldy, *Ent.*, 37, p. 279, 1904.

Somewhat scarce. Single individuals were found breeding in August and September near colonies of *Tragopa cimicoides*, and other social forms, with whom they shared the attentions of ants.

***Boethoos globosa*, sp. nov.**

(Pl. III, fig. 10.)

Head ferruginous brown, shining, faintly punctate, wider than long, projecting forwards; margins of genae arcuate, produced and extroverted, bordered with yellow; clypeus small, rounded, not projecting beyond genae; eyes grey and prominent; ocelli grey, twice as far from one another as from eyes, and situated on a level with the centres of the eyes.

Pronotum ferruginous brown, polished, finely punctate, slightly pale behind, highest above shoulders; metopidium convex, sloping, twice as wide as high; humeral angles sub-triangular, bordered with yellow; posterior process tectiform, slightly carinate, sub-acuminate, depressed transversely behind shoulders; a bright yellow spot at the middle of the lateral margin on either side.

Tegmina yellowish brown, semi-transparent, the proximal discoidal cell infusate; veins broad, dark, punctured at the base.

Abdomen short and globose; underparts and legs ferruginous; tibiae decorated with yellow; tarsi black.

Long. 3.50 mm. Lat. 1.75 mm.

Type: Female.

A small reddish brown shining globose species, taken August 5th, 1922, among a colony of *Horiola arcuata* which had been partly covered with vegetable fibre by ants.

Boethoos reticulata, (Fabr.).

Parmula reticulata, Stal, *K. Sven. Vet-Akad., Handl.*, 8, 1, p. 29, 1869.

Parmula = *Boethoos*, Kirkaldy, *Ent.*, p. 279, 1904.

(Pl. VI, fig. 7, nymph.)

Small colonies were found on June 28th, 1922, and on August 4th, 1922, in each case completely enclosed by ants under a shelter of vegetable dust. Early in September, broods appeared on a flowering leguminaceous tree in a clearing which seemed to be attractive to Membracidae, for other forms, such as *M. fusca* and *M. c-album* and *E. monoceros*, etc. were taken upon it. Here, although ants swarmed over the tree and visited the different Membracid colonies, *B. reticulata* lived free, and uncovered. There is considerable variation in the depth of the

ground colour of the pronotum, and in the extent and continuity of the markings, but my collections show that this is not dependent on whether or no the species is covered up by ants.

Vanduzea testudinea, sp. nov.

(Pl. III, fig. 5.)

Head greenish yellow, marked with brown, polished, shining, sparingly pubescent and punctate; base somewhat sinuate; genae rounded, with margins extroverted; clypeus very small, rounded, not projecting beyond genae, hairy at the apex; eyes yellowish grey; ocelli yellow, nearer to margins of eyes than to each other, and situated on a level with the centres of the eyes.

Prothorax sordid white, pubescent, densely punctured with brown, convex, highest above shoulders; humeral angles blunt, not prominent; median carina very slight; metopidium sloping, wider than high; posterior process blunt, tectiform, excavated behind the shoulders, not quite reaching tips of the tegmina. A narrow band along the anterior margin, borders of humeral angles, and apex of the posterior process brown. A broad, irregular, dark brown band extending over the metopidium on either side, often confluent in the middle of the dorsum behind the shoulders, and then turning at an obtuse angle to the lateral margin; a second transverse brown band extending across the dorsum half-way to the apex of the posterior process.

Tegmina hyaline; with a dark, clouded spot in the middle, and another at the apex; veins black and boldly marked.

Underparts bright brown; legs brown, spotted with yellow.

Long. 4.0 mm. Lat. 2.0 mm.

Type: Female. Sexes alike.

A small series taken August 19th, 1922, on *Vismia ferruginea*, where they were attended by ants, which had built a slight shelter of vegetable fibre round them.

Amastris elevata Funkh.

Amastris elevata Funkhouser, *Journ. N. Y. Ent. Soc.*, XXX, no. 1, p. 27, 1922.

(Pl. VI, fig. 5.)

This form, which Mr. Funkhouser has kindly determined for me by comparison with his type, is evidently near to *A. obtegens* Fabr. It is a bright green shining species, taken in July and August on a coarse, green herb in a clearing close to the Station. The eggs are laid in clusters of 30-40 in the epidermis of the stem. The nymphs are green; and as they feed flattened close to the petioles and mid-ribs of the leaves, they are almost invisible to a casual glance. Their presence, however, is often betrayed by the swarms of ants which attend them.

Amastris funkhouseri, sp. nov.

(Pl. III, fig. 9.)

Head pale green, roughly sculptured, punctate, coarsely pubescent, about as long as wide; margins of genae sinuate; clypeus small, hairy, not extending

much beyond genae; eyes pink; ocelli bright red, equidistant from each other and from eyes, and situated on a level with the centres of the eyes.

Pronotum greenish yellow, obscurely marked with orange, roughly sculptured, punctate, hirsute; metopidium wider than high, perpendicular, convex, with a faint yellow keel; humeral angles blunt, little produced; dorsum rising abruptly behind the shoulders in a high carinate ridge which slopes backwards and downwards to the apex of the posterior process, which is sub-acute, tectiform, laterally compressed, somewhat excavated behind shoulders, and just reaches the apex of the tegmina.

Tegmina yellowish hyaline, punctate along the costa and at the base; veins pale brown.

Abdomen orange; underparts and legs yellow; tarsi black.

Long. 4.2 mm. Lat. 2.0 mm.

Type: Female.

One female taken by sweeping in a clearing, September 4th, 1922. I have much pleasure in naming this species after Mr. W. D. Funkhouser of the University of Kentucky, in recognition of his assistance in the determination of this and other specimens.

***Amastris vismiae*, sp. nov.**

(Pl. IV, fig. 4.)

Head yellowish brown, shining, faintly punctate, rather roughly sculptured, sub-triangular, broader than long, margins of genae nearly straight and slightly raised; clypeus small, sub-quadrate, hairy at the apex, and not projecting beyond margins of genae; eyes crimson, large, prominent; ocelli yellow, equidistant from each other and from eyes; and situated on a level with centres of eyes.

Pronotum bright reddish brown, punctate, with scattered hairs, arcuate, highest above shoulders, laterally compressed, furnished with a strong median carina which is edged with black; metopidium perpendicular; humeral angles rounded, not prominent; posterior process acute, just reaching apex of tegmina.

Tegmina yellowish hyaline; veins brown; clavus and half of the corium covered by the pronotum.

Long. 5.0 mm. Lat. 2.0 mm.

Type: Female. Male with the abdomen pinkish orange; otherwise sexes alike.

A small series taken in the latter part of July and in August on the brown flowering twigs of the *Vismia ferruginea*, where they were attended by ants. This species readily takes wing when disturbed, but soon returns to the food-plant.

***Aphetea affinis*, sp. nov.**

(Pl. III, fig. 4, 4a.)

Head wider than long, coarsely punctate, base slightly sinuate; margins of genae arcuate; clypeus small, blunt, and not projecting beyond genae; eyes brown; ocelli pink, very small and inconspicuous, twice as far from one another as from eyes, and situated on a level with the centres of the eyes.

Pronotum coarsely punctate; metopidium rounded, sloping, twice as wide as high; dorsum slightly sinuate in the middle, somewhat excavated behind the shoulders; humeral angles blunt, not prominent; median carina percurrent, not very marked; posterior process tectiform or boat-shaped, with the apex acute and just reaching the tips of the tegmina.

Tegmina with the costal area very coriaceous, heavily punctate and coloured like the pronotum; remainder of the corium and the clavus, hyaline, with a small black spot at the apex; three parallel basal veins; discoidal cells absent. The first, second, fourth and fifth apical cells are arranged radially round the apex of the third basal area, and the third apical cell is strongly stilate.

Long. 3.0 mm. Lat. 1.5 mm.

Type: Female.

A small inconspicuous species which varies considerably in colour. Eight of the nine females in the series have the head and the pronotum pale grass-green in life, but the colour fades in cabinet specimens. The males and the remaining female are greenish brown, with a few obscure brown blotches on the lateral margins and the apex of the posterior process.

This form was taken early in July on the shoots of a vine in an open place in the forest. The eggs were laid in clusters of twenty to thirty together, in slits in the epidermis of the stems. The females remained seated on the eggs, and they and the nymphs, which ran actively over the plant, were much visited by ants.

Cyphonia clavata (Fabr.).

Cyphonia clavata, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 503, 1846.

This species was found from June to September in small numbers on certain favourite shrubs. Both sexes were taken, but I was not able to find the earlier stages, and attempts to induce the adults to oviposit on "sleeved" twigs met with no success. *C. clavata* readily takes wing, but soon returns to the plant. A score or more may be found on the same branch, feeding on the under-sides of the leaves, but they are not gregarious in the sense in which that term has been elsewhere in this paper. Ants abounded on the same foliage, but were never observed to feed from the Membracids. Nevertheless the resemblance between the two forms was very striking in the field, and the mimicry only failed because the Homoptera were sedentary unless disturbed, and did not run restlessly about as the ants did.

* *Cyphonia nasalis* Stal.

Cyphonia nasalis Stal, *K. Sven., Vet-Akad. Handl.*, 3, 6, p. 34, 1858.

A female collected at the Station, November 5th, 1920, answers to Stal's description of this species. It has the facies of *C. clavata*, but is larger and has longer and coarser black hairs. The abdomen and legs are pale with black apices; the paired spines at the base of the posterior process are blunt; and below each, on the side of the thorax, is a shining swollen white spot.

Ceresa vitulus (Fabr.).

Ceresa vitulus, Amyot et Serville, *Hist. Nat. Ins. Hemip.*, p. 540, 1843.

Ceresa vitulus, var. *minor*, Fowler, *B.C.A., Homop.*, II, p. 103, 1909.

Both the type form and the variety were equally common on the coarse herbage in the clearing at the back of the Station.

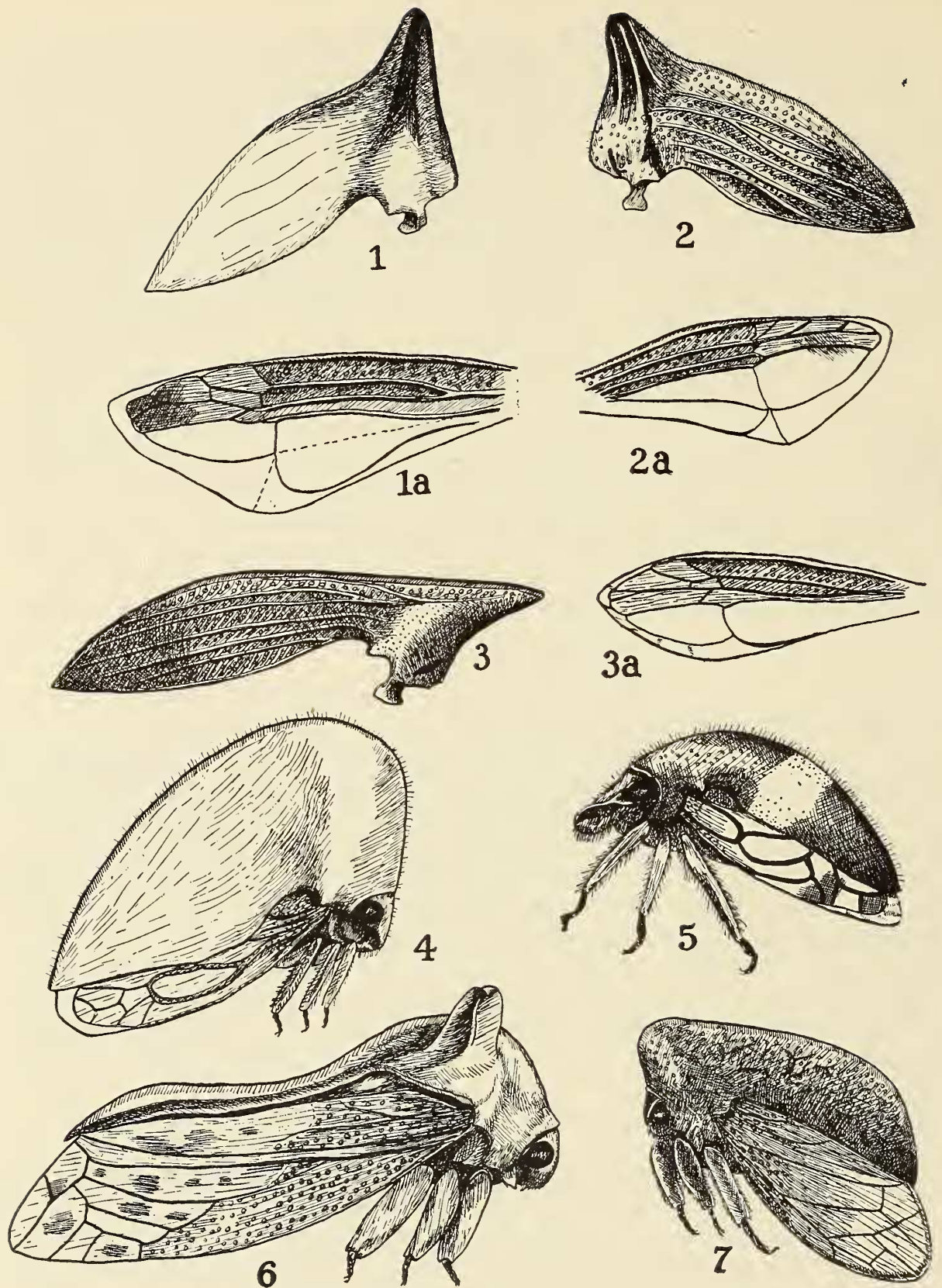


Plate IV.—1, *Hille herbicola*, prothorax; 1a, *H. herbicola*, tegmen; 2, *Gelastigonia hirsuta*, prothorax; 2a, *G. hirsuta*, tegmen; 3, *Polyglyptodes flavicostatus*, prothorax; 3a, *P. flavicostatus*, tegmen; 4, *Amastris vismiae*; 5, *Boethoos cinctata*; 6, *Centruchoides felinus*; 7 *Stegaspis galeata*, Walk., male.

Polyglytodes flavocostatus, sp. nov.

(Pl. IV, fig. 3, 3a.)

Head testaceous brown, punctate, not shining, wider than long, base sinuate; margins of genae nearly straight; clypeus very small, articular margin angular, apex rounded, bristly, scarcely extending beyond margins of genae; eyes brown; ocelli small, yellow, equidistant from each other and from the eyes, and situated on a level with the centres of the eyes.

Prothorax yellowish brown, strongly punctate, furnished with a short, straight horn projecting obliquely forwards and continuous behind with the line of the dorsum, which is non-sinuate and straight from the tip of the frontal horn to the middle of the posterior process, whence it is gradually curved to the apex; basal part of the metopidium carinated, nearly perpendicular and forming an obtuse angle with the frontal horn; humeral angles insignificant; median carina yellow, edged with black, very strong, percurrent; posterior process acute, tectiform, just reaching tip of tegmina, furnished with five yellow costae on either side, extending from the shoulders to the apex.

Tegmina with one discoidal area, the third apical area small; clavus very large; basal and costal regions semi-coriaceous, and punctate, with raised yellow veins.

Underparts and legs brown; tarsi black.

Long. 6.50 mm. (sine cornu. 5.50 mm.). Lat. 2.0 mm.

Type: Female.

A single example was taken August 18th, 1922, on the *Vismia* tree.

Species ?

The determination of the two following species has presented some difficulties. According to the keys of Stal, they should be referred to *Oxygonia* Fairm.² and *Hille* Stal, respectively, on the strength of the presence or absence of a discoidal cell in the tegmen. But Fowler remarks that this character is not always reliable, and moreover *Hille*, according to Stal, is furnished with longitudinal ridges on the pronotum, which are obscure in my series. A closely allied species in the Hope Museum at Oxford is labelled *Hemitycha* (= *Oxygonia* Fairm.) *erythropus* Burm. Mr. Funkhouser has kindly examined my specimens, and refers them to *Polyglytodes* Fowler, but they are different in facies to the types in the British Museum, and the humeral angles, though not very prominent, are more conspicuous. On the whole it has seemed best to follow Stal's arrangement, though when the long-needed revision of this part of the Smiliinae is undertaken, it may be necessary to remove these forms elsewhere, or perhaps include them both in the same genus.

Hille herbicola, sp. nov.

(Pl. IV, figs. 1, 1a.)

Head pale green, punctate, shining, wider than long, with a dark median line; base slightly sinuate; margins of genae sinuate; clypeus rounded and hairy at the apex, and not projecting for as much as half its length beyond genae; eyes red; ocelli yellow, equidistant from each other and from eyes, and situated on a level with the centres of eyes.

² *Oxygonia* = *Gelastigonia* Kinkaldy, *Ent.* 37, 1904.

Pronotum grass-green, coarsely punctate, not pubescent, with a few, slight, irregular, yellowish costae along the lateral margin; metopidium perpendicular, rising into a short, straight, laterally-compressed horn, which is rather variable in height, non-carinate at the sides, and marked broadly with dark brown; median carina sharp, percurrent, edged with black; humeral angles obtusely triangular, not very prominent; dorsum sinuate at base of horn, and gradually sloping to the apex of the posterior process, which is tectiform, acute, and just reaches the tips of the tegmina.

Tegmina with the exposed portion green, coriaceous, and heavily punctate at the base, and infuscate and sub-hyaline at the apex; space divided by the claval suture very large and hyaline; three basal veins; basal areas long and narrow; one discoidal cell; apical areas elongate, the third strongly stylate and very small.

Underparts and legs greenish yellow; femora black.

Long. 6.00 mm. Lat.: 2.50 mm.

Type: Female. Sexes alike.

Social: taken in June on low herbage in a clearing near the Station, and attended by ants. The nymphs are green, elongate, and very effectually concealed in their natural surroundings, as they feed flattened against the stems of the host plant. A specimen labelled *T. notata* Walk. in the British Museum, is evidently very close to this species.

***Gelastigonia hirsuta*, sp. nov.**

(Pl. IV, fig. 2, 2a; Pl. VI, fig. 4.)

Head green, with a black, median line, sub-triangular, rather wider than long; base slightly sinuate; margins of genae nearly straight; clypeus hairy, sub-acute, and not projecting for quite half its length beyond genae; eyes red; ocelli yellow, equidistant from each other and from eyes, and situated on a level with the centres of eyes.

Pronotum grass-green, coarsely punctate, hirsute; metopidium carinate, perpendicular, about as wide as high, continued above into a short, straight, laterally-compressed horn, which is provided with three carinae on either side, and with an irregular, black stripe which is continued downwards over the shoulders; humeral angles sub-triangular, not very prominent; dorsum strongly carinate, scarcely at all sinuate at base of horn; posterior process tectiform, acute, just reaching apex of tegmina, and furnished on each side with five or six longitudinal costae.

Tegmina with the exposed portion green, punctate, and coriaceous, infuscate towards the apex and along the third basal area; venation as in the last species, but destitute of a discoidal cell.

Underparts and legs greenish yellow.

Long. 6.00 mm. Lat. 2.75 mm.

Type: Male.

Two examples taken June 16th, 1922, in a colony of *Hille herbicola*, which species they closely resemble.

***Telemona spiniger**, sp. nov.

(Pl. III, fig. 3.)

Head wider than long, roughly sculptured, polished, shining; margins of genae sinuate; reflexed; clypeus very small, laterally bi-lobed and rounded at the apex, not projecting beyond margins of genae; base of head somewhat sinuate; eyes pale grey, prominent; ocelli translucent, equidistant from each other and from eyes, and situated on a level with the centres of the eyes.

Pronotum rough, coarsely punctured, shining, not pubescent, much compressed behind shoulders; metopidium twice as high as wide, inclined backwards, slightly sinuate when seen from the side, carinate; humeral angles triangular, strongly produced; dorsum furnished with a high blunt prominence above the shoulders; median carina percurrent and strongly compressed; posterior process very acuminate, lateral margins arcuate when seen from the side, just reaching apex of tegmina.

Tegmina entirely free, yellow, hyaline, punctured at the base, and with a small black spot at the apex of the clavus; veins brown.

Femora somewhat swollen; tibiae spined.

Long. 11.0 mm. Lat. (int. hum.): 6.0 mm. Alt: 6.0 mm.

Type: Female.

Described from a female collected at the Station, June 24th, 1922. The colours are evidently faded. The head and pronotum are yellow (? green in life) thickly mottled and punctured, especially along the dorsum, with ferruginous (? red) and the underparts and legs are yellow (? green). This form differs from other species of the genus with which I am acquainted in the shape of the metopidium and posterior process.

Bocydium globulare (Fabr.).

Bocydium globulare, Fairmaire, *Ann. Soc. Ent. Fr.*, 2, IV, p. 508, 1846.

This remarkable Membracid was taken by sweeping in June and again more abundantly in September. The nymphs were not found; and all the examples of both sexes that were obtained were feeding singly on the undersides of green leaves where they were comparatively conspicuous objects. They took wing readily when disturbed, and apparently were never attended by ants, although the latter were common on the foliage around them.

Centruchoides felinus, sp. nov.

(Pl. IV, fig. 6.)

Head ferruginous, with thick yellow pubescence, wider than long, base arcuate and emarginate; margins of genae prominent, sinuate, deeply notched at the apex; clypeus small, depressed, trilobed, with the lateral lobes small and angular and the median lobe larger and rounded, not projecting much beyond genae; eyes brown, prominent; ocelli grey, equidistant from each other and from eyes.

Pronotum ferruginous, punctate, thickly pubescent, furnished above the shoulders with two, stout, pointed horns; metopidium perpendicular, carinate; horns strongly tri-carinate, flattened above, their breadth at base almost equal

to their length; a well-marked percurrent carina arises between the horns and extends to the apex of the posterior process.

Posterior process very acuminate, slightly longer than the abdomen and triangular in section; seen from above, it is narrow at base, slightly expanded behind the scutellum and tapers gradually to the apex; seen from the side, it is sinuate, sloping abruptly to the scutellum, and is then slightly raised again and depressed towards the apex.

Scutellum dark brown, with white tomentose patches, about as wide as long, truncate behind, with a pale denticle lying on either side of the posterior process.

Tegmina ferruginous, semi-opaque, not quite half as long again as abdomen, with numerous, brown, scale-like patches; veins brown, base and costal margin heavily punctate; one discoidal and five apical areas. Wings hyaline grey, with four apical cells. Abdomen rufous brown; ovipositor long and stout; underparts and femora sooty brown to black, with white tomentose patches; tibiae ferruginous, flattened and dilate; tarsi sooty.

Long. 8.0 mm.

Lat. (int. corn.): 3.0 mm.

Type: Female.

Sexes alike, except that the abdomen of the male is short and crimson in colour.

Four females and a male taken in August on the branches of a small tree with reddish bark, common in the clearings. The venation of this form differs somewhat from that of Fowler's type species (*C. laticornis*).

Lycoderes hippocampus (Fabr.).

Lycoderes hippocampus, Stal. *K. Sven, Vet-Akad. Handl.*, 8, p. 52, 1869.

A solitary and rather scarce species, taken occasionally in August and September. The early stages were not found. The insect fed in the axils of the leaves of low shrubs in shady places. The pale green body, seen through the transparent part of the tegmina, and enclosed by the dark apical areas behind and by the pronotum above, gives the whole insect a remarkable resemblance to a partly withered leaf stipule. This form, according to my observations, is not visited by ants.

Stegaspis laevipennis (Fairm.).

Stegaspis laevipennis, Walker, *List Homopt. Ins. Brit. Mus.*, p. 635, 1850.

Two females taken September 9th, 1922, on a red-barked shrub in a clearing. The insects fed in the axils of the leaves, and bore an unmistakable resemblance to stipules.

Stegaspis galeata Walker.

Enchenopa galeata Walker, *List Homopt. Ins. Brit. Mus.*, p. 486, 1850.

Stegaspis galeata Walker, *Ibid, Supp.*, p. 341, 1858.

Hypsoprora insignis Buckton, *Mon. Mem.*, 1909.

Stegaspis insignis, Funkhouser, *Journ. N. Y. Ent. Soc.*, XXX, no. 1, p. 34, 1922.

(Pl. IV, fig. 7; Pl. V, fig. 5.)

A gregarious form, attractive to ants, and not uncommon on green vines and juicy shoots in shady places from June to September. The colour of my

series varies from ochreous brown to rusty black, and the sexes are dimorphic, for the male lacks the frontal horn.

The above synonymy is suggested after examination of Walker's specimens in the British Museum, which are identical with the examples from Kartabo. Mr. Funkhouser has suggested to me that *S. folium* Oliv. may be a synonym. Stal (K. Sven. Vet-Akad Handl., 8, p. 54, 1869) supposes *S. folium* to be identical with *S. melanopetala* Oliv. Stal's description is of the male sex, and Stoll's figure 80, and possibly 48 also, probably represents this unhorned form. Stoll's figure 31, according to Stal, is of *S. fronditia* Fabr., and this is evidently near to, if not identical with, the female of the species under discussion. Until the types of the older writers can be re-examined, Walker's name has priority over that of Buckton.

Ischnocentrus niger Stal.

Ischnocentrus niger Stal, *Ofv. K. Vet-Akad. Forh.*, p. 293, 1869.

A male and female taken at the beginning of August, feeding singly on the bark of twigs in a shady place. Their appearance was very ant-like, and some of the ants, which were numerous on the foliage, were gathered round them.

Fowler (*B.C.A., Homop.*, II, p. 155) regards Stal's species, *I. niger* and *I. ferruginosus*, as the sexes of the same form. This conclusion is borne out by my two examples, of which the male is black and the female is rich brown. The only structural difference between them is that the posterior process of the male is slightly reflexed, while that of the female is straight.

Tolania scutata Stal.

Tolania scutata Stal, *K. Vet-Akad. Handl.*, 3, 6, p. 37, 1858.

A female, taken September 5th, 1922, on the bark of a shrub at the edge of a clearing. Stal's type was a male, but I have little doubt from his description that this belongs to the same species.

Tropidaspis carinata (Fabr.)

Tropidaspis carinatus, Stal, *K. Sven. Vet-Akad. Handl.*, 8, p. 56, 1869.

(Pl. V, fig. 4.)

This form was fairly common in shady places on the bark of twigs, and was invariably attended by ants. It was, moreover, the only species over which the ants showed any solicitude when disturbed. Twice I found a small colony with their eggs completely enclosed with some Coccids under an earth-crust. When the latter was broken into, some of the nymphs were seized by the ants and carried for a short distance, but they were soon abandoned. At other times, *T. carinata* fed in the open; and although the ants visited the colonies, they did not display unusual perturbation when the Membracids were interfered with. In the males of my series, the tegmina are more opaque and the general colour is darker than in the females. The pale fascia across the scutellum is sometimes almost absent in both sexes.

***Tropidaspis minor*, sp. nov.**

(Plate V, fig. 3.)

Head deflexed, longer than wide, punctate; ocelli situated close to upper margins of eyes.

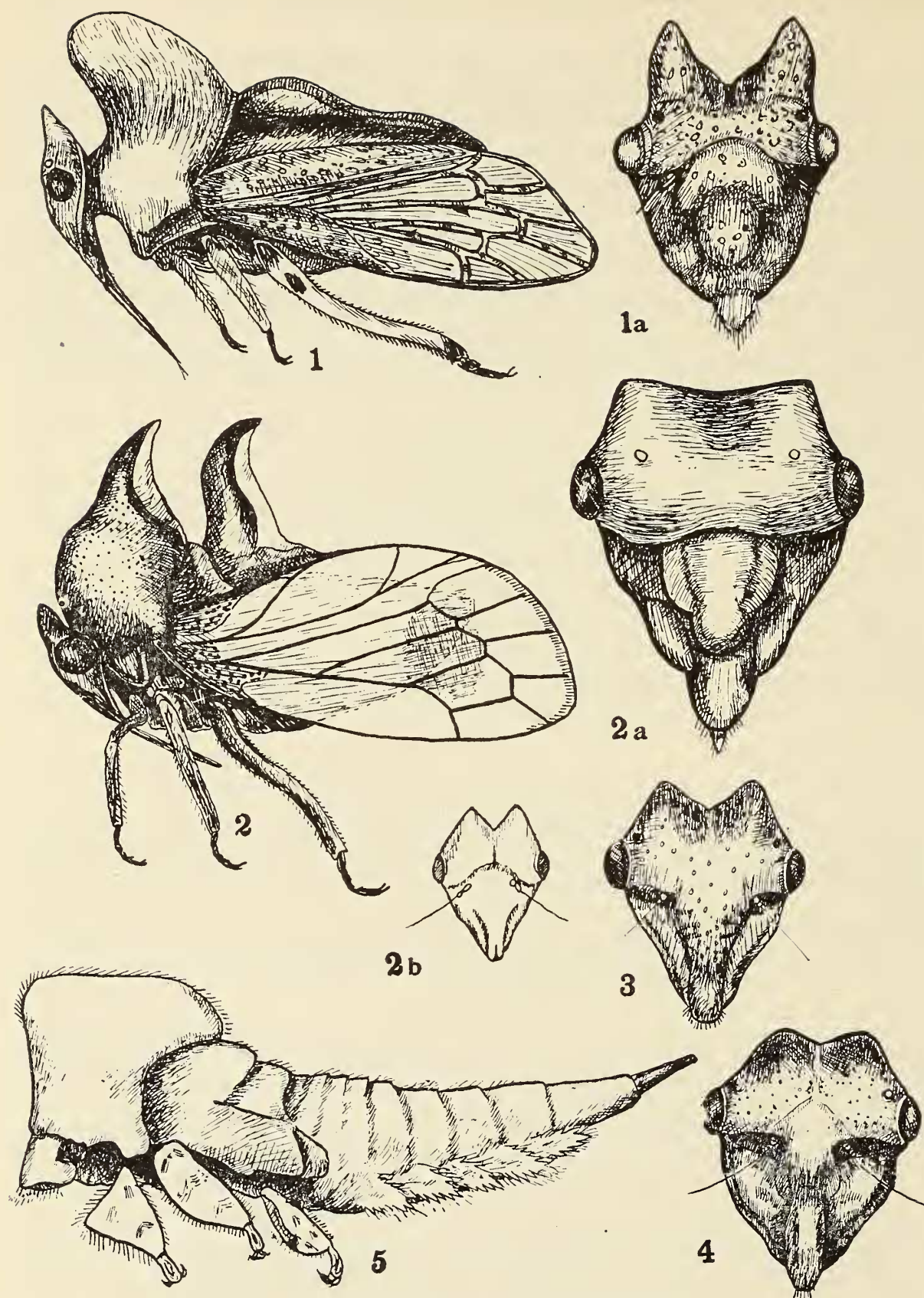


Plate V.—1, *Tropidaspis cornuta*; 1a, *T. cornuta*, frontal view of head; 2, *Lophyraspis armata*; 2a, *L. armata*, frontal view of head; 2b, *L. armata*, head of nymph of the third instar; 3, *Tropidaspis minor*, frontal view of head; 4, *T. carinata*, Fabr., 5, *Stegaspis galeata*, Walk., nymph of the fifth instar.

Pronotum with the humeral angles blunt and little produced; somewhat excavated behind the shoulders; posterior margin gently sinuate, and furnished with a slight median carina. Scutellum as long as the abdomen, acuminate, and with a sharp percurrent carina extending to the apex.

Head, prothorax and scutellum pale testaceous, densely punctured and variegated with black and chestnut brown.

Tegmina hyaline, coriaceous, and punctate at the base; veins raised and broad, spotted with brown and white.

Legs and tarsi sordid ochre; the hind tibiae curved and furnished with three rows of spines.

Long. 3.50 mm.

Lat. 1.50 mm.

Type: Female.

Resembles the last species, but is smaller and paler in colour, and the base of the head is more acutely lobed.

Two females were taken at the end of July on their flat oval egg-cases on the bark of a shrub in the jungle, attended by ants.

***Tropidaspis cornuta*, sp. nov.**

(Plate V, figs. 1, 1a.)

Greenish yellow, heavily mottled and punctate with black and brown. Head sub-triangular, much longer than wide, base produced into two conical lobes above the eyes; margins of genae somewhat arcuate; clypeus very small and scarcely projecting beyond genae; eyes brown; ocelli yellow, situated at the base of the lobes, close to, but above, the inner margins of eyes.

Pronotum hexagonal, with the anterior margin rounded and raised, posterior margin straight, and somewhat impressed in front of shoulders; furnished with a strong keel, which is produced above the shoulders to form a high, laterally-compressed, rounded crest, projecting forwards.

Scutellum not quite as long as the abdomen, very narrow, acuminate, with a sharp percurrent keel, which, seen from the side, is somewhat sinuate, and laterally-compressed behind the middle.

Tegmina semi-opaque, coriaceous, punctate at base and along the costal and claval margins; veins broad, raised, and decorated with lighter spots. Under parts pitchy brown; tibiae and tarsi yellow, spotted with black; hind tibiae curved and furnished with three rows of small, black spines.

Long. 3.50 mm.

Lat. 1.50 mm.

Type: Female.

Male slightly smaller and paler.

The absence of discoidal cells, the position of the ocelli and the unarmed scutellum justify the inclusion of this form in *Tropidaspis*. The lobes of the base of the head are much more pronounced than in the type species, but *T. minor* is transitional in this respect.

T. cornuta is a small brown rough-looking insect. Two examples were taken in August on the petiole of a shrub in dank jungle. The female was sitting on a flat condiate egg-case, attended by ants.

***Lophyraspis fowleri*, nov. nom.**

Gerridius scutellatus Fowler, B.C.A., *Homop.*, II, p. 166, 1909. (*nec*
Lophyraspis scutellatus Stal.)

After a careful comparison of the characters determining the genera

Lophyraspis Stal and *Gerridius* Fowler, I have come to the conclusion that the distinctions between them are not well defined, and that therefore Fowler's genus, erected in 1909, cannot stand. Mr. Funkhouser writes to me that he is also of this opinion. The name *scutellus* being preoccupied in *Lophyraspis*, it is necessary to re-name Fowler's type species, and I suggest that it be known henceforward by the specific designation *fowleri*.

L. fowleri was found in July, in a shady clearing, on the shoots of a shrubby plant infested with *L. armata*. It was gregarious and was attended by ants. The Membracid itself has a peculiarly ant-like appearance when feeding, owing to its habit of raising its long, curved, hind tibiae and gently waving them to and fro in the same manner as its congener *L. armata* and many Aphididae.

The determination of the two following species has presented some difficulties, as I have not seen Stal's types.

The structure of the head closely resembles that of *Ischnocentrus* and *Tropidaspis*. Stal separated *Lophyraspis* and *Lamproptera* on the form of the base of the head, and the number of discoidal cells. Fairmaire remarks of *Lamproptera*, "elytres tout a fait semblables a celles des *Lycoderes* pour les cellules," and figures *L. vacca* with one discoidal cell as in *Lycoderes*. The only example of the genus to which I have had access is the single specimen of *Lamproptera stylata* Buckt., in the Hope Museum, and there the venation is identical with that of *Lophyraspis*; *Tropidaspis*, according to Stal, had no discoidal cell, and yet the venation is unmistakably of the same type. The discrepancy is due to the use of the term discoidal. In *Lophyraspis* the external, and only true, discoidal cell, is formed by the forking of the radial vein. The internal cell is really the radial-medial basal area, for the radial and medial veins are conjoint for some distance from the base of the tegmen. The same thing occurs in *Lamproptera stylata*. In *Tropidaspis*, all three main veins are distinct at the base, and the radial areolet is so elongated that its discoidal nature is masked. Fowler remarks that in his types of *Tropidaspis affinis*, there are two discoidals on one side and one on the other; this is probably due to the shifting of the bifurcation of the radial vein.

***Lophyraspis armata*, sp. nov.**

(Plate I, fig. 10; Plate V, figs. 2, 2a, 2b.)

Head bronze-black, punctate, triangular, rather longer than wide, base raised into a high, slightly sinuate crest, which is obtusely angulate laterally, and bi-cornulate only in the nymph; lower margins of the vertex produced above a deep sulcus in which the antennae are inserted; margins of genae sinuate; clypeus trilobed, not projecting beyond genae; ocelli equidistant between eyes and median line, and situated on a level with the upper margins of eyes, vertex between them strongly impressed.

Pronotum bronze-black, punctate, strongly convex; humeral angles obtuse and slightly prominent; median carina slight in front and rising behind into a high, backwardly projecting pointed crest, with the anterior edge ferruginous, blunt, and the posterior sharp and knife-like, with a black fascia bordered behind with white; posterior margin arcuate.

Scutellum ferruginous, shining, acuminate, scarcely longer than wide, marked laterally with white tomentose patches; median carina developed into a crest as high as that of the pronotum, rounded in front, recurved behind and bordered with black and white fascia; apex white. Tegmina hyaline, shining, polished, coriaceous and punctured at base, with a median cloudy brown spot; veins and margin brown. Underparts and femora sordid yellow; tibiae and tarsi black; hind tibiae long, curved, hairy, furnished with numerous small spines; hind tarsi very long.

Long. (front of head to apex of tegmen): 4.00 mm. Lat. 1.20 mm.

Type: Female.

Male similar, but with dorsal crests less developed.

These Membracids were taken several times between June and August on twigs in shady places. They are social, and remain upon, or near, their egg-cases, where they are much visited by ants. They and the dull green nymphs are active and move about freely. When feeding, the adults have a curious habit of waving their long hind tibiae in the air as Aphides are accustomed to do. This gives them a remarkably ant-like appearance in the field; and when ants are present in numbers it is difficult to distinguish one from the other.

Stal (*K. Sven. Vet-Akad. Hand.*, 1869, p. 56) in a footnote describes *L. cristata*, in which the pronotum and scutellum are both furnished with high crests. The description is inadequate for accurate determination, but it is quite possible that *L. cristata* is identical with the form described here.

Lophyraspis pygmaea (Fabr.).

Lophyraspis pygmaea, Stal, *K. Sven. Vet-Akad. Handl.*, 8, 1, p. 55, 1869.

This form resembles the last but is smaller. The pronotum is bronze-black and punctate, convex and rounded behind, with a very slight median keel. The base of the head and scutellum are bright brown, and the underparts and legs are sordid yellow.

The scutellum is triangular, rather longer than wide, transversely convex, with a black median keel more developed behind, where it dips abruptly to the apex which is white and very acute.

Tegmina as in the last; but with the apical margin more broadly infusate. The hind tibiae are long and curved, and furnished with short close spines.

Endoiastus productus Osborn.

Endoiastus productus Osborn, *Zoologica*, Vol. III, no. 10, p. 233, 1921.

(Plate I, fig. 8, eggs.)

The genus *Endoiastus* was erected by Fowler for the reception of *E. caviceps*; *E. productus*, which differs from the type species in its dark colour, more slender form and narrower head, was described by Osborn from material collected by Dr. Wheeler from *Tachigalia* at Kartabo in 1920.

In 1922, I found this Membracid only in one spot, where, however, it bred in numbers from June to September. The eggs were laid in slits in the epidermis of the stems, petioles, and on the undersides of the leaves of the *Tachigalia*. About thirty were deposited together, usually in a double, but sometimes in a single, row, and the adults and nymphs clustered together in crowds under the foliage. The nymphs were active, dark green and not mealy, but the adults were sluggish and seldom moved unless touched.

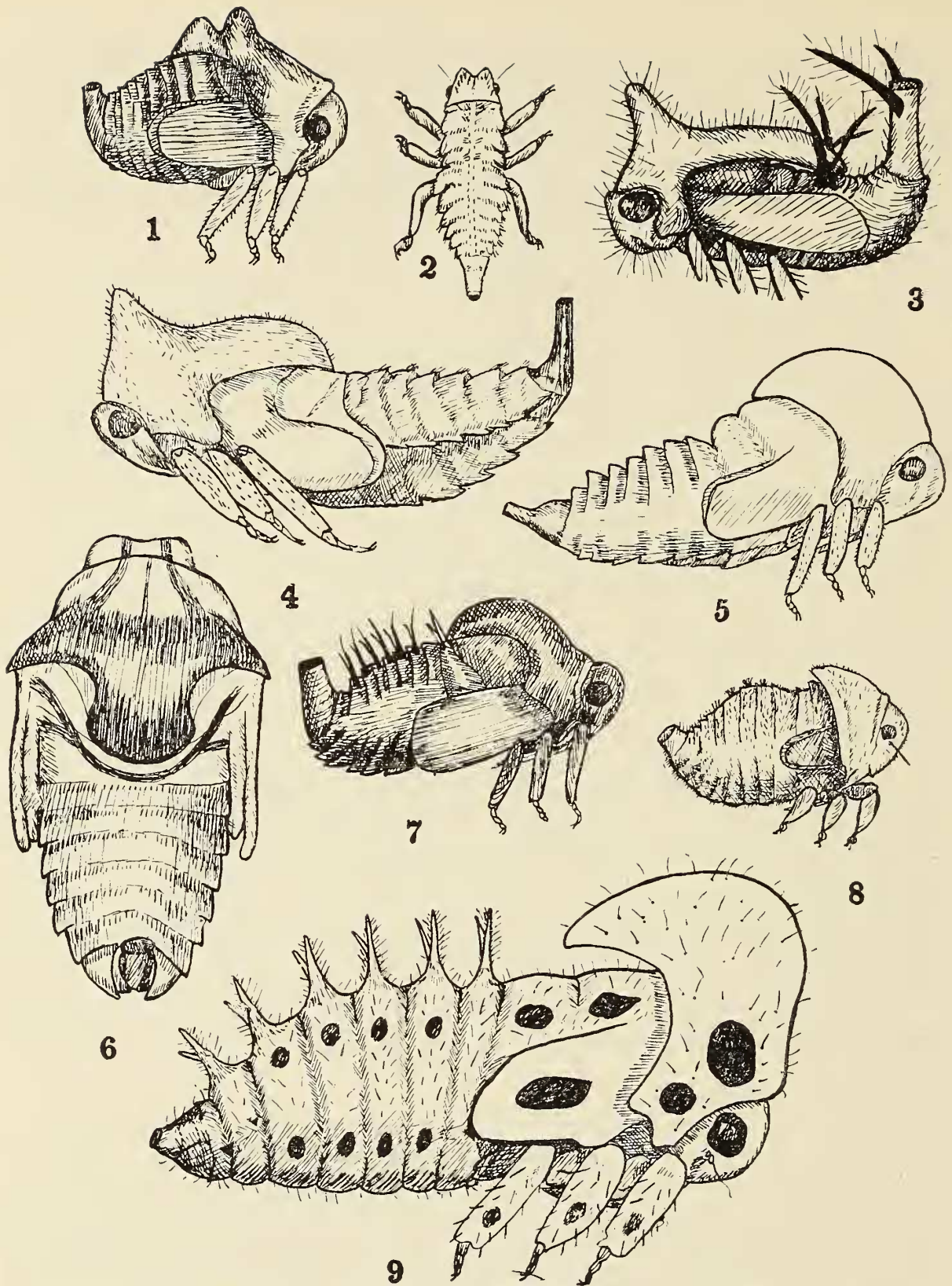


Plate VI.—Nymphs of, 1, *Bolbonota aspidistrae*, fifth instar; 2, *Enchenopa bifenestrata*, Funkh., second instar; 3, *Campylenchia nutans*, Germ., fifth instar; 4, *Gelastigonia hirsuta*, fifth instar; 5, *Amastris elevata*, fifth instar; 6, *Tragopa cimicoides*, Fabr., fifth instar; 7, *Boethoos reticulata*, Fabr., fifth instar; 8, *Tropidocyta bulbosa*, fifth instar; 9, *Membracis c-album*, Fairm., fifth instar.

Dr. Wheeler (*op. cit.*, no. 4) has given an account of the relations of the host plant to the ant which live in the hollow petioles of the leaves and feed on the excreta of the Membracids.

Aethalion reticulatum (Linn.), var. *albo-nervosum*.

Aethalion reticulatum, Germar, *Mag. der Ent.*, IV, p. 95, 1835.

Aethalion reticulatum, var. *albonervosum* Fowler, *B.C.A.*, p. 171, 1909.

(Plate I, fig. 11, eggs.)

Taken in some numbers in August on the branches of a tree within fifty yards of the Station landing-stage. This species is gregarious and the females, which are sluggish and reluctant to take wing, can be picked off the eggs with the fingers. The egg-cases, though large, are of the usual Membracid type, with the eggs embedded in pale brown elliptical masses of wax. The colony was much visited by ants.

This form possesses scarcely a single distinctive Membracid character. But the head of the nymph, apparently less modified than that of the adult, shows affinities with certain Centrotinae; and therefore it has seemed best here to follow Fowler's arrangement, and include this anomalous genus in the Membracidae.

GEOGRAPHICAL DISTRIBUTION.

The Membracid fauna of the Kartabo forest is intermediate between that of the Panama region and the Amazon basin. Thus of forty species whose distribution is given by previous writers, twelve are peculiar to Guiana and Brazil, and ten to Guiana and the Central American area. As sixteen are common to all three regions, it is evident that many neotropical Membracidae have an extensive range; and as further data are obtained, we shall probably find that numerous forms have a wider distribution than appears at present. This is already clear if we take the genera rather than the species, for almost every genus of the Kartabo collection is widely distributed between Lat. 20° N. and Lat. 25° S.

At the same time, the extensive range of many forms is rather remarkable, for, as I have pointed out elsewhere, the primaeval forest which occupies so much of the South American Continent is not the most favoured environment for most Membracidae. Thus of sixty-nine species at Kartabo, forty-two were taken in and around clearings, and only thirteen inhabited the deeper forest. Fourteen were intermediate in their haunts, but even this group was confined to the lighter trails and glades where the shade was not too dense. Of course even the clearing dwellers are shaded by vegetation. The only form which seems able to bear the full glare of the sun is *Enchenopa lanceolata*, which inhabits low plants on the open river

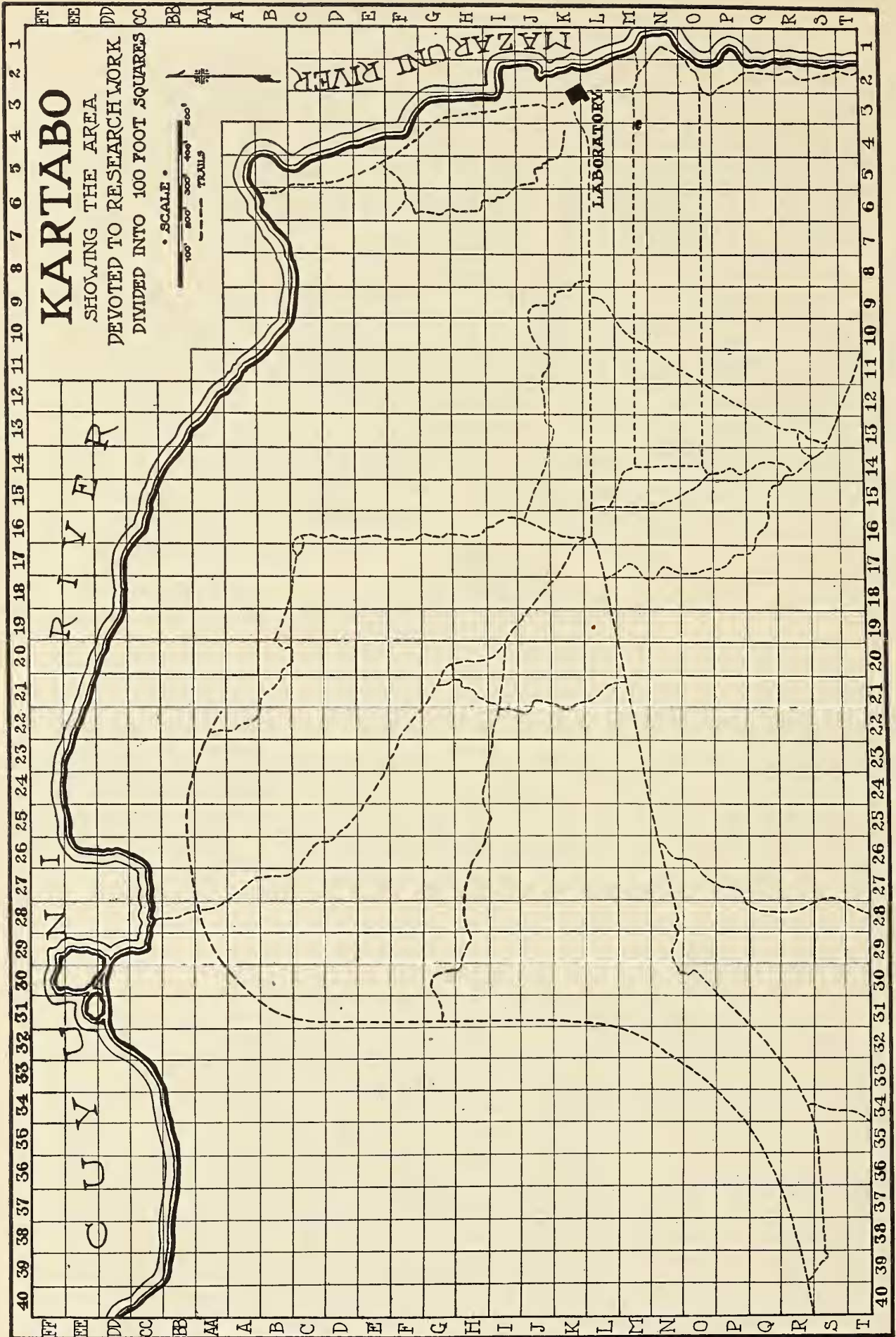


Plate B. Area devoted to research at Kartabo.
 Drawing by John Tee-Van.

bank, and is exposed from sunrise to sunset. But the darker, damper parts of the forest are poor in Membracidae, and as the greater part of equatorial South America is clothed with this deep forest, the wide dispersal of the light-loving forms is curious. Unless they can sustain themselves among the tree-tops, a point on which at present we have no information, they must have followed the lines of more open forest, and clearings in virgin jungle are relatively scarce and restricted in extent. We are perhaps too apt to regard the tropical forest zone as a homogeneous area, and overlook that within its bounds conditions vary greatly, so that, to many species, migration is only possible along certain definite tracks or routes.

LIFE-HISTORIES AND HABITS.

The Membracidae of Kartabo are divided rather sharply into two natural groups, the forest forms and the clearing forms. The first group is much the smaller, and except for *Darnis partita* and *D. latior*, includes chiefly such insonspicuous species as *Tropidocyta gibbosa*, *Tropidaspis carinata*, *Endoiastus productus* and the *Bolbotas*. Even of these, many haunted places where the shade was not too dense; and the dark swampy forest along the river banks was almost destitute of Membracidae. On the other hand, the secondary growth round the Station, and in the abandoned cassava clearings further afield, was rich both in individuals and in species. This was partly owing to the change in flora induced by felling of the forest, and partly because Membracidae are light-loving insects. This is not to imply that they seek the full sunshine,—the only species that seemed able to tolerate the open ground was *Enchenopa lanceolata*,—but most other forms sought bright diffused light under foliage round the clearings.

Professor Poulton (*Buckton, Mon. Mem.*, p. 9) quotes Mr. Nelson Annandale's observations in Malacca, where "insect-eating animals retire to rest during the hottest hours of the day, and at this very time, insects, including such cryptic forms as the stick-like Phasmids, move about freely, assume forms, and occupy environments in which they are quite conspicuous." Funkhouser (*Mem. Cornell Univ. Agric. Exp. Stat.*, p. 392, 1917) observed that the Membracidae of the Cayuga Lake Basin were most active during the hottest parts of the day. Possibly the Kartabo Membracidae were on the whole more active in the morning, and the usual time for the emergence of

the adults was in the forenoon; but this is only a general impression, and the eggs seemed to hatch at all hours. I have captured *Tragopa cimicoides* and *Ceresa vitulus* on the exposed tops of herbage in clearings between three and four o'clock in the afternoon; but most of the insects appeared to take cover under the leaves when the sun was high. Nearly all the species recorded are rather sedentary, and occupy positions where they are permanently shielded from the direct rays of the sun.

The marked division of the Kartabo Membracid fauna into forest and clearing forms opens the question whether many of the latter have extended their range of late years, in correlation with the extension of settlements and cultivated ground. From examination of collections in the Georgetown and New York Museums, it appears that the species from Kartabo, when represented, are generally distributed along the coast and up the rivers as far inland at any rate as Kaieteur, and probably have a foot-hold everywhere where the forest is scanty enough to afford the optimum of light and shade. Many places up the rivers have been cleared and settled for the last two hundred years, and the immigration of light-loving forms is not necessarily recent.

Without special botanical knowledge, it has not been possible to give a list of hosts, but my notes indicate that many forms are monophagous, or at least restricted to a few species of plants. Probably this is the reason why many species are gregarious and form colonies, not only with their own kind, but with other genera. Some of these are recorded below:

Tragopa cimicoides

Enchenopa bifenestrata

Tragopa partita

Tragopa cimicoides

Horiola arcuata

Boethoos distinguenda

Membracis c-album

Membracis fusca

Boethoos reticulata

Enchenopa monoceros

Horiola arcuata

Boethoos globosa

Horiola ferruginea

Vismia ferruginea

Vanduzea testudinea

Tragopa guianae

Tragopa tripartita

Vismia ferruginea

In passing, one might perhaps comment on the superficial resemblance of some of these gregarious forms. Such, for instance, are *Tragopa guianae* and *Vanduzea testudinea*, *Horiola arcuata* and *H. ferruginea* and *Boethoos globosa*.

The Membracidae often occur in such numbers on an individual host that it is rather remarkable that the plants attacked are seldom distorted or galled. The only species at Kartabo which regularly gives rise to a specific deformity is *Tropidocyta gibbosa*. Here the inflorescence of a certain shrub is attacked when in bud. The stem becomes nodose and woody, and the buds abort and fall off. The reason for the apparent immunity of most hosts is that the Membracids infest only the stem, and do not touch the shoots or leaves until the latter are fully formed.

The egg-masses of Membracidae are usually distinctive objects, and those of which I have records can be referred to two principal types. In one the eggs are deposited in a mass of waxy colleterial fluid, which soon hardens on exposure to the air, and the epidermis of the plant is little, if at all, lacerated. In the other, there is very little fluid, and the eggs are deposited in incisions in the plant's tissues. With certain exceptions, the first is the general type of the Membracinae and Centrotinae; the second is that of the other sub-families. The form and colour of egg-cases of the first type have already been dealt with in the list of species at the commencement of this paper, and vary considerably in different genera.

Some older writers have credited the Membracidae with parental care for their eggs, on the ground that some forms remain seated on the mass for some time after oviposition is complete. The idea probably arose because the process is often a somewhat lengthy one, and the mother sits quietly sucking for hours or even days while the mass beneath her grows larger. But I am not quite sure that the idea is as far-fetched as some other writers have supposed. There is no need to credit the female Membracid with conscious instincts of maternity; but the fact that she remains on her nursery may serve to protect it, either by keeping away certain enemies, or, conceivably, by regulating the temperature or moisture.

Early in July I had colony of *Bolbonota aspidistrae* under daily observation, and the following are extracts from my diary:

- July 4th: Six nests and some late nymphs beside the Puruni Trail. Females in five of the nests.
- July 5th: Two more nests with females on the same plant. Took three females away from nests.
- July 7th: Three out of four remaining females still on eggs. One unoccupied nest hatching.
- July 8th: More nymphs hatching from one occupied and one empty nest. Ants round all nests. Two deserted nests look crumbling.
- July 10th: Nymphs still emerging. Two empty nests rather shrivelled and discoloured; a third half broken away.
- July 12th: All females gone and the two latest nests beginning to hatch out. The nest originally unoccupied and two whose females were removed do not seem to have produced nymphs, for the eggs are shrivelled.

Observation on three more marked nests of the same species later on showed that nymphs would appear when the female was removed; but out of fifteen or so eggs in each mass, only half a dozen nymphs emerged, and examination showed that the remaining eggs were flaccid, shrivelled and apparently broken.

On the other hand, some experiments with *Enchenopa bifenestrata* gave negative results, and the proportion of hatching eggs seemed unaffected by the removal of the female.

The duration of embryonic life is not easy to determine since the eggs are not all laid at once and therefore hatch at irregular intervals. Observations on certain species gave the following approximate results:

<i>Enchenopa bifenestrata</i>	8 days
<i>Enchenopa lanceolata</i>	6 days
<i>Tragopa partita</i>	?5 days
<i>Bolbonota aspidistrae</i>	6 days
<i>Campylenchia nutans</i>	7 days

The nymphal period was longer than I expected to find it in the tropics where all life seems keyed to such a high and exuberant pitch. The following list is compiled from certain species whose nests were isolated and kept under daily observation:

Instars	1st	2nd	3rd	4th	5th
<i>Bolbonota aspidistrae</i>	2 days	5 days	4 days	6 days	7 days
<i>Lophyraspis armata</i>	—	—	?4 days	6 days	8 days
<i>Aconophora compressa</i>	3 days	5 days	?4 days	6 days	9 days
<i>Enchenopa bifenestrata</i>	—	3 days	3 days	5 days	9 days

I have also kept colonies of fifth instar nymphs of *M. tectigera* and *Enchenopa nutans* under observation for eight days and ten days respectively.

The nymphs of most of the species described in this paper are often quite active, and seek to escape by dodging round the stem of the plant, but in no case were they ever seen to hop. The adults are frequently disinclined to move, but when they make up their minds to leave the plant, they spring away like lightning. It is easy to see a Membracid arrive. It is still more easy to see a valuable specimen depart; but in the intermediate stages of its transit it is usually invisible. Many forms have a remarkable homing faculty; and within half an hour of their departure, they may be found feeding again on the very branch from which they previously fled headlong.

ATTENDANCE BY ANTS.

It has long been known that certain species of Membracidae are visited by ants for the sake of their excretion, the so-called "honeydew." Belt (*Naturalist in Nicaragua*, p. 227, 1874), Rice (*Insect Life*, p. 243, 1893), Baer (*Bull. Soc. Ent. Fr.*, p. 306, 1903), Branch (*Kansas Univ. Sci. Bull.*, VIII, 1913), Lamborne (*Trans. Ent. Soc.*, January, 1914), Funkhouser (*Mem. Cornell Univ. Agric. Station*, II, 1917), and others, have published observations on this point.

In all the known cases, the association seems to be a sort of loose commensalism, and not the close interdependence that is found between ants and some other insects. Rice states that the nymphs of *Entylia sinuata* reached the adult state in two weeks if ants were present and in one if they were absent; but the statement is rather general, and possibly experiments with different controls might have given other results. Branch considered that ecdysis was irregular in the absence of ants; but as the experiments were conducted in the laboratory, it is more probable that malnutrition was responsible. Funkhouser, who investigated this problem, found

that the presence or absence of ants had no effect on development. I endeavoured to work out this point, but the attempts were not wholly successful, owing to the difficulty of isolating the colonies of Membracids on their natural food-plant under conditions where ants were numerous and heavy rain-storms frequent. As far as they go, my results confirm those of Funkhouser.

Most of the records suggest that the ants feed only from the anal tube. This is not altogether correct, for although the visitors have learned that stimulation of the Membracid secures the extrusion of a drop of excreta, yet they readily take what had already fallen. This gives the key to the origin of the association. Ants of various species swarm over the foliage in the forest whether Membracids are present or not. They visit the nectaries on the leaves of plants, bird-droppings, excreta of other insects, such as Coccids, etc. Hence a colony of Membracidae is a god-send and a crowd quickly gathers round it. In fact, so numerous and so ubiquitous are foraging ants, that where a few examples only of a species of Membracid are taken, it is not always easy to say whether it is regularly visited or not, and it is no wonder that most gregarious Membracidae are thus attended.

The list of unattended forms given elsewhere in this paper shows that they all are solitary when adult.³ In fact habit rather than physiology seems to determine whether ants shall or shall not visit them. Thus *Stegaspis laevipennis* and *Lycoderes hippocampus* were not attended; *Stegaspis galeata*, which occurs in colonies, was visited freely. However, Funkhouser (*op. cit.*, p. 399) brings evidence to suggest that social habits are not the only factor concerned. The host plant often plays a considerable part. *Endoiastus productus* feeds on *Tachigalia* shoots, and the hollow petioles are occupied by ants (Wheeler, *Zoologica*, 1921), which naturally resort to the manna that the Membracids strew at their doors.

According to my observations at Kartabo, when an ant-attended colony is disturbed, the ants attack the invader savagely, but pay no attention to the Membracids. The only exception to this was in a colony of *Tropidaspis carinata*, which had been completely covered up with vegetable fibre. When the roof was broken in, half a dozen ants each seized a nymph, but after carrying them aimlessly for a short distance, they dropped them without further interest. *T. carinata*, *Horiola arcuata*, and *Boethoos reticulata* were the

³ The early stages are not known.

only forms that I found completely enclosed in ants' nests on twigs. Here at least I expected to find evidence of more interdependence; but after some study I came to the conclusion that the association was fortuitous, for all three species flourished equally well when unenclosed. The covered twig was always infested with Coccids, and probably these, rather than the Membracids, were objects of care. The Membracids seem indifferent whether the ants cover them up or not. When the shelters are broken, the adults jump away and the exposed nymphs, as I have frequently observed, continue to feed, sometimes for days afterwards, on the exposed bark, although movement a few centimetres to right or left would bring them under cover again.

I must express my thanks to Dr. W. M. Wheeler, who has been good enough to determine the following species of ants for me:

Camponotus femoratus Fabr.; taken in attendance on *Tragopa cimicoides*, *Endoiastus productis*, *Lophyraspis armata*, *Horiola arcuata*.

Crematogaster (*Orthocrema*) *limata* Smith; var. taken in attendance on *Horiola arcuata*.

Azteca paraensis Ferel; taken in attendance on *Campylenchia nutans*.

Pheidole sp.; taken in attendance on *Amastris elevata*.

Pheidole fallax Mayr.; taken in attendance on *Boethoos testudinea*.

ENEMIES.

Our present knowledge of the enemies of Membracidae is very inadequate, and I regret that I am able to add little or nothing to it.

Aconophoroides gladiator and *Cymbomorpha vaginata* were occasionally found to be captured by hunting spiders, and *Membracis tectigera* was taken from a web. Internal parasites in the nymphs were not observed. Possibly the constant visits of ants tend to prevent this kind of attack. Nevertheless a Myrmarid, of species as yet undetermined, was seen to parasitize the eggs of *Tragopa cimicoides*, *Aphetae affinis*, and *Campylenchia nutans*. The Myrmarid, which was slow and furtive in its movements, like many of its family, crawled leisurely over the eggs, ovipositing in each, in some cases while the Membracid female was still sitting on the mass, and before laying was finished. Ants were running around,

and even over the Membracid, but the parasite completely disregarded them and crept under the mother's wings to accomplish its task.

FIELD OBSERVATIONS ON FORM AND COLOUR.

Buckton's *Monograph of the Membracidae* includes an interesting and suggestive essay by Professor Poulton, on the "Meaning of the Shapes and Colours of the Membracidae." In the writer's own words, his remarks are merely suggestions, and are in no sense dogmatic utterances. "I feel," he says, "that in this most remarkable group of insects, the examination of figures, or even of the specimens themselves in a museum, can only occasionally afford us the foundation for a valuable opinion as to the bionomic meaning of the forms and patterns. But such an examination continually suggests possible interpretations which may lead the observer of the living species to think, and may sometimes even direct him into the right track."

It has been of interest to compare my notes taken in the field with the interpretations that study of similar forms in the cabinet suggested to such an authority as Professor Poulton; and possibly a discussion of observations made independently from the two points of view may not be out of place here. It may well prove that my own conclusions will not hold good for the same species found under different conditions elsewhere; but field observations on tropical Membracidae are somewhat scanty, and if only for this reason, the following notes may be worth recording.

Following Professor Poulton, let us take first the genus *Membracis*. All the forms collected at Kartabo are comparatively large and conspicuous insects, black, usually variegated with white, and in one instance (*M. fasciata*) with orange. Professor Poulton suggests that the foliaceous pronotum may resemble one of the semi-circular pieces of leaf that the leaf-cutting ants carry in procession to their nests. This theory, though ingenious, is hardly acceptable to anyone who has seen the supposed mimics and models in their natural haunts, although it is true that the ants will carry off, not only blackened leaves, but also bits of stick and petals of flowers. The general type of colouring that prevails throughout the genus is bold and striking, and by no means harmonizes with the surroundings. This kind of colouring is usually supposed to be associated with

“unpalatableness,”⁴ and I advance another explanation, which is, however, quite hypothetical. These Membracids are gregarious, and adults and young frequently feed together on the same twigs. The young forms are covered with a white flocculent powder, which renders them so conspicuous that we can only suppose that enemies which hunt by sight recognize them as unpalatable and pass them by. The colour pattern of, say, *M. tectigera* is bold enough by itself, but when seen upon a plant infested with nymphs of its own kind, it possibly has some cryptic value, falling into line, not with its vegetable surroundings, but with its own conspicuous and unpalatable brood. I put forward this theory with reserve, for it could hardly apply to the orange and black species with whose bionomics I am not acquainted; but it would cover the case of *Enchenopa lanceolata*, also a black and white form, with a curved frontal horn, which bears not the least resemblance to a cut leaf. This species has likewise mealy white young, and forms conspicuous colonies on low-growing plants.

On the other hand, *Atta* mimics may well exist, and the instance observed by Slater (Poulton, *Proc. Zool. Soc.*, p. 4, June, 1891) may be a case in point. Infestation by *Amastris elevata* has a superficial resemblance to an *Atta* raid in progress. The green crescentic forms of the Membracidae are certainly very like pieces of cut leaf, and as the colonies are usually attended by ants, the *mise en scene* is complete. But it seems unnecessary to interpret this as mimicry of harvesting ants. The colour and form of the Membracids are equally well adapted to resemble leaf stipules, or the foliaceous expansions of the stem which are sometimes found in green plants, and this I believe to be the real explanation. Other forms in my collection to which this applies are *Cymbomorpha vaginata*, *Telamona spinigena*, *Hille herbicola* and *Gelastigonia hirsuta*. It may be remarked that all those species were taken only on green plants. *Amastris vismia*, a brown species close to *A. elevata* in all but colour, was taken only on the reddish twigs of *Vismia ferruginea*.

The suggestion that the general form and colour of genera such as *Enchenopa* and *Tropidocyta* are cryptic is supported by my field observations. *T. neglecta* and *Campylenchia nutans* fed in the axils

⁴ Mottram (*Proc. Zool. Soc.*, p. 253, 1917), has sought to determine experimentally the factors which cause animal colour patterns to appear conspicuous in nature. According to his conclusions such a form as *M. c-album* must be considered eminently conspicuous, for it is black with white superimposed upon it, and one at least of the component colours is nearly circular in outline.

of leaves, and simulated buds or stipules. The long-horned forms such as *E. albidorsa* and *E. monocercus* resembled broken petioles or thorns, though it should be remarked that in every case the host plant itself was thornless. *Aconophora compressa*, which is superficially similar in shape to the last two species, likewise resembled a bit of stick; and the nymphs, which have short red horns, fed in rows along the stems and were very thorn-like.

The question of the colour background is of interest. Most of the Membracids collected fed, not on the green leaves, but on the brown or reddish stems of the plants, and I never found a bright green Membracid on a brown stem. A certain slender straggling tree, common in open places, had the twigs and undersides of the leaves covered with rusty brown powder. This tree was the chosen host of many Membracidae, themselves all brown. Such were *Enchenopa monoceros*, *Campylenchia nutans*, *Aconophoroides gladiator*, *Centruchoides felinus*, and the solitary form *Stegaspis laevipennis*, which was almost indistinguishable from a leaf stipule. On the other hand *Stictocephala indeterminata*, *Aphetea affinis*, *Amastris elevata*, etc. appeared only on green stems or twigs. Nevertheless complete colour harmony with surroundings is not nearly so important (speaking from the point of view of a human being) as some students of animal coloration would have us believe. One is gradually forced to the conclusion that an insect with variegated pattern can pass muster very well anywhere in the chequered light and shade of the forest, among the bewildering profusion of vegetable shapes and forms. For instance, the remarkable genera *Pterygia* and *Hypsoprora* are roughly sculptured and coloured black and white, a form and pattern which, if seen in a museum, would immediately suggest imitation of a natural background of lichened bark. Unfortunately I obtained only one example of each genus, but in each case the insects were taken on green foliage. The *Pterygia* was actually feeding at the base of a leaf some distance from the ground, and until I took it in the net, I mistook it for a resting beetle or microlepidopteron, deceived by the long antenna-like supra-humeral processes. The *Hypsoprora* resembled a bit of fallen bark or a bird dropping; but in this case I am not sure that the insect had not been disturbed by my passage, and alighted momentarily on the leaves.

Sphongophorus is represented in the collection by *S. guerini*. This grotesque insect was found singly on the shoots of shrubs and

herbaceous plants in clearings, and bears an undoubted resemblance to a broken or withered leaf stem.

Species of the genus *Umbonia* have been compared to red-striped thorns. *U. spinosa* has been taken at Kartabo, but I did not find it myself, and made no field observations. There seemed to be no common plant with thorns of this type. *Aconophoroides gladiator*, which has a brown striated body and a sharp red-tipped horn, was found on brown thornless twigs. In both cases colour alone probably affords adequate concealment, and the shape of the pronotum is relatively unimportant.

The genera *Boethoos*, *Vanduzèa*, and *Stictocephala* were generally represented at Kartabo by small forms whose colour and pattern, while inconspicuous, did not appear to have any special cryptic or mimetic design. The same applies to various species of *Tragopinae*. Some of these Membracids form colonies and are attended by ants under shelters of vegetable debris; others feed openly on leaves and stems. It must not be overlooked that forms which are individually inconspicuous may be quite obvious when present in numbers. A single example of *Tragopa cimicoides*, for example, is easily missed; but a branch where the egg-laying females cluster like berries is a comparatively striking object.

Ceresa vitulus and its variety *minor* were abundant in the sun-bleached herbage of clearings. Their greenish colour serves to conceal them, and the sharp supra-humeral spines suggest that they would be unpalatable to some enemies.

The habits of *Bolbonota* are interesting. Professor Poulton thus comments on the genus: "They closely resemble seeds, also small lumps of earth. They would be well-concealed upon rough bark." According to my observations, *Bolbonotae* of all species sat in plain view on the broad leaves of *Aspidistra* and other plants in open trails and clearings. In spite of their small size, they were visible several feet away; but they were not readily recognized because they closely resembled the little shrivelled scales and bits of bark which fell in profusion from the foliage overhead. They were very active, taking wing at the least alarm, and when they were present in numbers, the pit-pat when they alighted on the leaves was plainly audible. *Tropidocyta bulbosa* was frequently taken in the same places. In fact, from the point of view of habits, this species is very closely related to *Bolbonota*.

Darnis partita and *D. latior* are solitary when adult, and are both conspicuously coloured black and yellow forms. They feed in the axils of leaves in the shade of the forest. Certain other Homoptera, for instance, some of the Cercopidae and Jassidae, which haunted the deeper forest, likewise tended to conspicuous patterns of black, red and yellow.

Stegaspis and *Lycoderes* are both cryptically coloured genera. *Lycoderes hippocampus*, which fed in the axils of leaves of low-growing plants, was a fine example of resemblance to a bract or stipule. *S. galeata* is beautifully fashioned like a bit of dead leaf. The sexes are dimorphic, since the male has no pronotal horn and the nymph is a remarkable form with foliaceous legs and an elongated abdomen with ctenate lateral lobes. It feeds closely pressed against rough twigs with which its colour harmonizes admirably and the comb-like processes which clasp the stem on either side further tend to obscure its outline. *Bocydium globulare* was not uncommon, but I am unable to suggest an explanation of its extraordinary form. It was a solitary and comparatively active species, usually found a few feet from the ground. At first sight I occasionally mistook it for a Culicid or other small Dipteron, though to suggest mimicry here is hardly justified. That remarkable insect, *Heteronotus armatus* and its allies must be regarded as mimics of Hymenoptera. This species frequented the upper surfaces of leaves in open sunny places. They took wing with a loud buzzing noise and were capable of considerable, though slow, flights. Their appearance when flying is much like that of a large Chalcid or yellow Aculeate, and it is quite possible that we have here an example of Mullerian rather than of Batesian mimicry, for the spines of the pronotum are capable of inflicting a sharp stab when the insect is handled. The resemblance to a Hymenopteron is less striking when the Membracid is at rest, as it lacks the quick jerky movements of a wasp. Perhaps in compensation for this *Heteronotus* is wary and readily takes wing. This applies also to the curious species *Cyphonia clavata*, which was not exactly gregarious, although several individuals were generally to be found on the same bush. The resemblance to an ant is as striking in the field as in the cabinet, but, having achieved the appearance of the model, the mimic fails to reproduce its behaviour. It feeds chiefly on the undersides of the leaves in open places, and as it is sedentary, unlike the restless ants, which it should be remarked are common on the foliage round it, its immobility tends to betray it.

But like *Heteronotus*, it is wary, and a rustle, such as would be produced by a bird alighting on the bush, is sufficient to send every *Cyphonia* into the air.

I agree with Professor Poulton (*Proc. Ent. Soc. London*, p. 19, 1913) that the fact that a mimic does not reproduce the actions of its supposed model, is no argument for assuming that the resemblance between them is due to chance; and where an insect is structurally incapable of mimicking behaviour, it is interesting to find greater wariness or wing power by way of compensation, so that if the deception is detected, the mimic can fall back on its second line of defence, and take refuge in flight.

Some of the small Centrotinae show the exact reverse of the *Cyphonia* case. *Ischnocentrus niger*, *Lophyraspis fowleri*, and *Lophyraspis armata* are not in the least ant-like in form and yet they are apparently ant mimics. These forms are social and cluster thickly along twigs and stems where they are freely visited by ants. The hind legs are long, black, and curved and during feeding they are raised into the air and waved to and fro.

The casual observer has the impression of a mass of ants with restless limbs. When the plant is shaken, the ants rush hither and thither to attack, and the Membracids, which are alert and active, rush up and down with them. Without close inspection it is impossible to distinguish between the Homoptera and their attendants. Probably the action was originally nothing more than a rhythmical motion similar to what we see in sucking Aphides, and has secondarily become an effective "mimicking" device.

The association of Membracidae with ants has perhaps played a part in the evolution of their colour and form. The ants attack any creature which touches the plant, and thus undoubtedly afford protection to the colonies of Homoptera that they attend. At the same time, their bustling presence often betrays their hosts. A list, which is given in detail below, was prepared of the Kartabo Membracidae, not including those species of which only one example was obtained, or of which no notes were made. The remaining species were divided into those attended, and those not attended by ants; and each division was as far as possible classified into cryptic, mimetic and neutral forms, the last including all species which were inconspicuously coloured and yet bore no apparent resemblance to natural objects. As far as they go, the results are interesting. Out of thirty-five ant-attended species, sixteen are cryptically coloured,

three are ant-mimics by behaviour, and eleven are neutral. Certain black and white *Membracids* are included, but could not be classified. In eleven species not attended by ants, four are cryptic, four are mimetic, and two have conspicuous colouring of the type usually called "warning." *Bocydium globulare* is included, but could not be classified. The results are proportionately the same if the genus instead of the species is taken as the basis of the table.

The conclusion to be drawn is that ant-attended forms actually have less need for exact cryptic or mimetic resemblance, and thus from the point of view of colour and form tend to fall into panmixia. This division contains a high proportion of neutral forms, and none that are structural mimics of other insects. The unattended species are usually solitary; probably the ant-association was due in the first place to gregarious habits. The list included all the structural mimics, three striking examples of cryptic colouration and no neutral forms. The inference is that unattended species have greater need of protective devices.

The cases of *Bolbonota aspidistrae* and *Tropidocyta bulbosa* are of interest. The adults are well protected by habit and appearance, and are not attended by ants except when egg-laying. Then the female sits motionless, sometimes for days together, on a white egg-case many times her own size, and thus forms part of a comparatively conspicuous object. At these times, and also during nymphal life, both species are freely visited by ants. This supports the view that gregarious habits conduce to the ant-association; and that ant-attendance partly compensates for imperfect cryptic or mimetic resemblance, and may even have helped to account for that condition.

Professor Poulton holds the view that the remarkable forms and colours of many of the Membracidae have been produced through strict natural selection. The sanction for this selection is the assumption that the enemies of the Membracidae have visual powers at least equal to those of man. Birds and reptiles suggest themselves as possible enemies, but evidence on this head is still very scanty. The principal enemies that I observed at Kartabo were spiders, and in this connection it may be remarked that two out of the three species taken were cryptically coloured.

The present state of our knowledge is too imperfect to allow us to dogmatize, but it is difficult to believe that the number and vigi-

lance of enemies that hunt by sight can account for a natural selection strict enough to produce the mimetic forms that we think we see. I say *think we see* advisedly, because among the wealth of animal and vegetable forms in the tropical jungle, it is easy to be over-ridden by a fascinating conception, and seek mimetic interpretation where simpler explanations would suffice. It should be understood that this is not to deny the justice of many such interpretations—*Cephonia clavata* or *Sphongophorus guerini* by themselves would silence such wrong-headed scepticism—but after some time spent in the jungle, I am driven to the conclusion that any object, preferably coloured green or brown, stands a reasonable chance of being overlooked.

The advocates of protective resemblance by natural selection urge that the selection is so strict that the least deviation from the optimum is wiped out. But critics of this theory have frequently pointed out that in the earlier stages there can have been no such close likeness to the model, and yet the mimic survived. Further, the more closely the mimic approached to the model, the less strict would the selection become, because the chance of escaping enemy scrutiny would be greater. I confess that, in spite of *Cyphonia clavata* and *Sphongophorus guerini*, I find this objection unanswerable at present.

Species Attended by Ants.

<i>Enchenopa monoceros</i>	
“ <i>bifenestrata</i>	
<i>Campylenchia nutans</i>	
<i>Bolbonota aspidistrae</i>	
“ <i>inaequalis</i>	
<i>Tropidocyta bulbosa</i>	
<i>Aconophoroides gladiator</i>	
<i>Aconophora compressa</i>	cryptic
<i>Amastris elevata</i>	
“ <i>vismiae</i>	
<i>Gelastigonia hirsuta</i>	
<i>Hille herbicola</i>	
<i>Aphetes affinis</i>	
<i>Centruchoides felinus</i>	
<i>Stegaspis galeata</i>	
<i>Aethalion reticulatum</i>	
<i>Ischnocentrus niger</i>	
<i>Lophyraspis fowleri</i>	mimetic
“ <i>armata</i>	

<i>Tropidocyta gibbosa</i>	
<i>Vanduza testudinea</i>	
<i>Boethoos distinguenda</i>	
" <i>reticulata</i>	
<i>Tragopa cimicoides</i>	
" <i>scutellaris</i>	neutral
" <i>guianae</i>	
" <i>tripartita</i>	
<i>Horiola arcuata</i>	
<i>Endoiastus productus</i>	
<i>Tropidaspis carinata</i>	
<i>Membracis c-album</i>	
" <i>fusca</i>	
" <i>tectigera</i>	not classified
" <i>arcuata</i>	
<i>Enchenopa lanceolata</i>	

Species Not Attended by Ants.

<i>Lycoderes hippocampus</i>	
<i>Stegaspis laevipennis</i>	
<i>Sphongophorus guerini</i>	cryptic
<i>Ceresa vitulus</i>	
<i>Heteronotus armatus</i>	
" <i>albospinosus</i>	mimetic
" <i>vespiformis</i>	
<i>Cyphonia clavata</i>	
<i>Darnis partita</i>	non-mimetic, ? warning
" <i>latior</i>	
<i>Bocydium globulare</i>	not classified

THE NYMPHAL FORMS.

The nymphs of the neotropical Membracidae are not often seen in collections; for owing to their soft bodies, they do not make satisfactory pinned specimens, and the collector, unless he is especially interested in the group, passes them by in favour of the adults. The development of some North American species, however, has been studied in detail, notably by Funkhouser (*Cornell Univ. Agric. Exp. Sta.*, mem. II, 1917)

The nymphs of most species, as far as is known, are imperfect editions of the adult form, and already the 4th and 5th instars fore-

shadow, as it were, the horn of *Enchenopa*, the rounded hood of *Boethoos* and *Tropidocyta*, the lateral processes of *Tragopa*, etc. The colouring also follows that of the adult in a general way. For instance, the nymphs of *Hille herbicola* and *Amastris elevata* are green, while those of *Enchenopa monoceros* and *Campylenchia nutans* are brown. The fact that the resemblance of form is less exact than that of colour supports the view that in many instances the Membracidae escape notice more by a general harmony with their surroundings than by definite resemblance to particular objects. The soft-bodied nymphs, which seem to need at least as much protection as the hard-bodied adults, often live side by side with the latter in the same environment, and yet lack those details of form and pattern which give their parents such wonderful likeness to surrounding objects; and which, we are sometimes told, are necessary to concealment, owing to the strict natural selection to which the species has been exposed.

We are hampered in any discussion of this subject by our ignorance of the early stages of some of the most wonderful of the "protected" species, such as *Hypsoprora*, *Sphongophorus*, *Heteronotus*, and certain *Lycoderes*. Nevertheless it is perhaps safe to venture on the generalization that as a rule conspicuously coloured adults have conspicuous nymphs and vice versa, although the conspicuousness is not always produced in the same way. For instance, at Kartabo, the black and white forms, *Membracis* and *Enchenopa lanceolata*, have nymphs with a white flocculent covering, frequently spotted with black. In the same way, adults which are cryptic as a rule possess nymphs which are cryptically, or at all events "neutrally" coloured. The only Kartabo species whose nymph is more brightly coloured than the adult is *Aconophora compressa*, in which the young of the 4th and 5th instars have rudimentary sharp red-tipped horns, and are decorated with white patches. It is possible that the frequent association with ants, as suggested elsewhere in this paper, may partly compensate for the absence of special protective devices in the nymphs of some species.

But certain forms do possess adaptive characters peculiar to the nymphal stages. Such are the pectinate lateral processes of *Stegaspis galeata*, which clasp the stem and undoubtedly tend to obliterate the outline of the insect; and the ? *Stegaspis* nymph, figured by Poulton (*Proc. Zool. Soc.*, p. 462, 1891) as an *Atta* mimic is perhaps another example of especial cryptic adaptation during development. Fowler

(*B.C.A.*, p. 4, 1909) remarks that the nymphs of *Membracis* "are very curious, being of the same shape as the perfect insect, but formed of separate upright narrow plates of different heights." This general statement is probably based on the remarkable specimen in the Hope Museum, figured by Buckton (*Mon. Membracidae*, pl. II, 4a) as the nymph of *M. continua*; but this form is not invariable for the genus, since the nymph of a typical species such as *M. c-album* is quite different in appearance, and has a semi-circular hood.

The nymphs of many genera possess dorsal spines which may be defensive in function. The number and arrangement vary a good deal even within the genus. For instance, according to Funkhouser, the nymph of *Campylenchia latipes* is furnished with broad median dorsal plates, whereas the nymph of *C. nutans* possesses long curved paired spines on the 2nd and 3rd abdominal segments, and near the orifice of the anal tube. These anal spines are remarkable and nothing is known of their function.

Enchenopa monoceros has a double row of little bristly lappets along the dorsum; *E. bifenestrata* is covered only with a short pilose coat; *Tragopa cimicoides*, *Amastris elevata* and *Gelastigonia hirsuta* are spineless; *Bolbonota inaequalis* has a double row of minute bristles; *Aconophora compressa* has a pair of strong curved spines on the mesothorax and on abdominal segments 2-4. The white nymphs of *Membracis* and *Enchenopa lanceolata* are thickly spined along the dorsum, but there seems to be no correlation between the conspicuous colouring and the presence of dorsal spines, for the cryptically coloured nymphs of *Boethoos reticulata* are spinous also. There are some remarkable nymphal forms in the Hope Museum. One, figured by Buckton (*op. cit.*, pl. 19, fig. 6) as *Holophora pertusa*, has a pair of stout backwardly-projecting spines on the mesothorax only. If it really belongs to this species and not, as is more probable, to *Umbonia*, it is of interest because the pronotum is developed into a high sharp point above the shoulders, which is lacking in the adult. Another specimen, labelled *Triquetra nigrofasciatus* Buckt. possesses both meso- and meta-thoracic spines. Two very curious forms appear in the *Cyphonia* series in this collection. One has the mesothorax and abdominal segments 2-3 strongly spined, and in addition, the pronotum is produced in front into a high bifid spike. Another has strong paired spines on the metopidium, and on the posterior process, while the mesothorax and abdominal segments 2-7 are likewise armed.

The phylogenetic value of the nymphal form is very doubtful, but if we are prepared to accept such evidence, we must suppose that the Centrotinae with their exposed scutellum are nearest to the ancestral type, although the extraordinary diversity of form in the sub-family forbids us to theorize. But certain Centrotinae possess a second character which is found only in the nymphs of other sub-families, namely the raised margin of the base of the head above the occiput. In *Tropidaspis carinata* this is small and only slightly lobed. In *T. minor*, the elevated part is more strongly bifid, while in *T. cornuta*, it is deeply cloven and bicornulate, almost as in *Lamproptera capreolus*. In *L. stylata* the lobes are produced into horns long enough to bear a superficial resemblance to antennae. In *Endoiastus productus* the head is laterally compressed and produced into two narrow lobes, divided by a groove. In *Lophyraspis pygmaea* the base of the head is little raised and scarcely sinuate, while in *L. armata* it is high, obtusely cuneiform, and almost straight. But the nymphs of both the last named species have the base of the head strongly divided into two conical horns as in *Tropidaspis cornuta*, and this character can be seen in the nymphs of other sub-families at certain stages. In *Amastris elevata*, for example, it is not distinguishable after the second or third instar, but in *Enchenopa bifenestrata* it persists up to the fourth.

The wing venation of some of the Centrotinae, such as *Bocydium*, *Lycoderes* and *Centruchoides*, is in its way as specialized as that of the other sub-families, but the venation of the *Tropidaspis-Lophyraspis* group, although it has suffered the modification by reduction common to all the Membracidae (Funkhouser, *Ann. Ent. Soc. Amer.*, vol. VI, no. 1) is in some respects more generalized. There is apparently no anastomosis between radius, media and cubitus, save that in *Lophyraspis* the two former are united for the basal third of their length. The important inter-radial and medio-cubital cross-veins occupy typical positions, and the only other cross-vein is a radio-medial as in some Membracinae. Mr. Funkhouser, in his valuable paper cited above, figures the wing pad of the nymphs of some species, and it is impossible not to notice that the venation of the adult *Tropidaspis* follows the primitive tracheation of more specialized forms, especially as regards the tracheation of the hind wing, which, although the venation is reduced, is in some respects more generalized than the tegmen.

KEY TO SPECIES INCLUDED IN THIS PAPER.

The following key to the species included in this paper is intended primarily for field workers in British Guiana, and is therefore necessarily somewhat arbitrary. It is based on the keys of Fowler in the *Biologia-Centrali-Americana*, but I have relied as far as possible upon the form and colour of the pronotum, rather than upon the characters of the venation, which are often confusing to those who have not previously studied the group.

- (B) A. Scutellum wanting, or obsolete, or entirely concealed by the pronotum.⁵
- (53) 1. Tarsi of equal length, or with the posterior pair the longest.
- (21) 2. Anterior tibiae dilated and foliaceous (*Membracinae*).
- (6) 3. Pronotum foliaceous, elevated, semi-circular or nearly so when seen from the side (*Membracis*).
- (5) 4. Black, or black and white.
- a. Entirely black. *Membracis fusca*.
- b. With an oval, and a crescentic, white spot. *Membracis c-album*.
- c. With two oval white spots. *Membracis carinata*.
- d. With a horizontal white band. *Membracis arcuata*.
- e. Anterior border and a spot on the dorsum, white.
Membracis tectigera.
- f. With two quadrate white spots on the dorsum
Membracis humilis.
- (4) 5. Black, variegated with orange. *Membracis fasciata*.
- (3) 6. Pronotum not rounded, nor foliaceous nor elevated when seen from the side.
- (12) 7. The pronotum produced in front into a longer or shorter horn. (*Enchenopa*).
- (11) 8. Dorsum even when viewed from the side.
- (10) 9. Horn not lobed at the apex.
- a. Colour chestnut: horn long. *Enchenopa monoceros*.
- b. Colour fawn-brown: horn curved. *Enchenopa nutans*.
- c. Colour black with a white band on dorsum
Enchenopa albidorsa.
- d. Colour orange or red: horn short. *Enchenopa pulchella*.
- e. Colour black, with white dorsal spots. . *Enchenopa lanceolata*.
- f. Horn short and stout: black with
dirty-white mark on dorsum. *Enchenopa bifenestrata*.
- (9) 10. Horn bi-lobed at apex: legs not very foliaceous (*Lycoderes*, *Centrotinae*).
- a. Horn stout: form triangular: colour brown
Lycoderes laevipennis.
- b. Horn black and slender: abdomen green
Lycoderes hippocampus.

⁵ The genera *Lycoderes* and *Stegaspis* properly belong to the sub-family Centrotinae, which has the scutellum developed and uncovered; but the foliaceous species included here are so readily confused with some of the *Membracinae*, that it has been thought better to place them in the first part of this key.

- (8) 11. Dorsum tuberculate when seen from the side.
Horn truncate at the apex.
a. Black and white: very asperatè: not laterally compressed
Hypsoprora aspera.
b. Black or brown: foliaceous: much compressed laterally.
(No horn in male) *Stegaspis galeata* [Centrotinae].
- (7) 12. Pronotum not horned in front.
- (14) 13. Pronotum with fungiform processes on dorsum. Head 3-lobed.
(*Sphongophorus*) with the processes resembling the capital letters EL. *Sphongophorus guerini*.
- (13) 14. Pronotum without fungiform processes.
- (16) 15. Pronotum with two long lateral processes above the shoulders, and a sharp tubercle at the posterior apex. Black and white
Pterygia uropygii.
- (15) 16. Pronotum without lateral processes above the shoulders.
- (20) 17. Pronotum obtusely angulate or rounded in front and strongly carinate. Dorsal ridge even, when viewed from the side. Legs scarcely foliaceous.
- (19) 18. Tegmina with three discoidal areas (*Tropidocyta*).
a. Covered with white tomentose hairs. . . *Tropidocyta pruinosa*.
b. Legs and pronotum pale ochreous, with an ill-defined brown patch on dorsum. On distorted shoots
Tropidocyta gibbosa.
c. Small and globose: dark brown: pronotum rounded in front, as in the last. *Tropidocyta bulbosa*.
d. Rather larger than the last two, and with the pronotum obtusely angulate in front. *Tropidocyta neglecta*.
- (18) 19. With two discoidal areas, but otherwise resembling the last genus (*Leiocyta*).
a. Pale, with a large bright chestnut mark on the dorsum
Leiocyta beebei.
b. Brown, with two ill-defined darker spots on the dorsum
Leiocyta spiralis.
- (17) 20. Form very small and globose: pronotum rounded in front and corrugated, rugose or tuberculated on the dorsum. Colour black or dark brown (*Bolbonota*).
a. Very small: with the tegmina entirely transparent
Bolbonota inaequalis.
b. Larger: tegmina opaque, and often spotted with yellow: dorsum corrugated. *Bolbonota pictipennis*.
c. As in (b): dorsum with two carinated tubercles
Bolbonota aspidistrae.
d. As in (c) but with the tubercles less high, and expanded transversely. *Bolbonota corrugata*.
- (2) 21. Anterior tibiae not foliaceous.
- (33) 22. Central (3rd) apical areole of the tegmen elongate, and truncate at its base. (Darninae.)

- (32) 23. Tegmina not more than half as long as wings: pronotum not nodose nor spined.
- (27) 24. Pronotum covering at least half of corium: head much broader than long.
- (26) 25. Colour black and yellow: surface polished.
 a. With three transverse dorsal yellow bands. *Darnis partita*.
 b. With the lateral margins only yellow. *Darnis latior*.
- (25) 26. Colour green. *Stictopelta indeterminata*.
- (24) 27. Tegmina almost free.
- (29) 28. Pronotum with a long horn: superficially resembling *Enchenopa*
Aconophora compressa.
- (28) 29. Pronotum without a horn: colour green.
- (31) 30. Pronotum compresso-elevate, semi-circular in side view
Cymbomorpha vaginata.
- (30) 31. Pronotum not elevated, but tectiform and convex
Rhexia kartabensis.
- (23) 32. Tegmina twice as long as wings: pronotum nodose and spined
 (*Heteronotus*).
 a. With the posterior spines comparatively short and stout
Heteronotus armatus.
 b. With the posterior spines longer and more slender
Heteronotus vespiformis.
 c. With the spines as in the last, but paler, and the form of the
 of the nodes somewhat different. *Heteronotus albispinosus*.
- Black and yellow wasp-like forms {
- (22) 33. The central (3rd) apical areole of the tegmen petiolate, that is to say, enclosed by a forked (Y-shaped) vein.
- (39) 34. Tegmina very coriaceous externally, with the veins scarcely distinguishable, and the free margins broad (*Tragopinae*).
- (38) 35. Tegmina almost entirely concealed by the pronotum (*Tragopa*).
- (37) 36. Shoulders produced: colour greenish brown.
 a. Shoulders very prominent. *Tragopa cimicoides*.
 b. Shoulders less pronounced. *Tragopa scutellaris*.
- (36) 37. Shoulders not produced: colour various.
 a. Entirely black. *Tragopa occulta*.
 b. Greenish: broadly marked with brown on the dorsum
Tragopa guianensis.
 c. Colour very variable, ranging from black to red; and the pattern also very diversified. *Tragopa tripartita*.
- (35) 38. Tegmina with the external half free (*Horiola*).
 a. Chestnut, with a pale saddle-shaped mark. *Horiola arcuata*.
 b. Bright brown, with the shoulders outlined with yellow
Horiola ferruginea.
- (34) 39. Tegmina membranous or coriaceous only along the external margin: veins distinct (*Smiliinae*).
- (43) 40. Tegmina with the clavus uncovered.
- (42) 41. Posterior process of the pronotum trifurcate (*Cyphonia*).
 a. Pronotum entirely black. *Cyphonia clavata*.
 b. With a white spot on either side of the prothorax
Cyphonia nasalis.
- Ant-like forms {

- (41) 42. Pronotum not trifurcate, but rounded, and furnished with two humeral spines. Colour greenish.....*Ceresa vitulus*.
- (40) 43. Tegmina with the clavus, and more or less of the corium, covered.
- (47) 44. Pronotum horned in front.
- (46) 45. Horn erect: colour green.
 a. Surface glabrous, not hairy nor costate..*Hille herbicola*.
 b. Surface hirsute and costate.....*Gelastigonia hirsuta*.
- (45) 46. Horn projecting obliquely forwards: colour brown, with yellow costae.....*Polyglyptodes flavicostatus*.
- (44) 47. Pronotum not horned.
- (49, 50) 48. Pronotum compresso-elevate, semicircular in side view.
 a. Green*Amastris elevata*.
 b. Brown*Amastris vismiae*.
- (50) 49. Pronotum compresso-elevate, not semicircular in side view.
 a. With an obtusely angulate process above the dorsum
Telemona spinigera.
 b. Flattened in front and raised and carinate behind
Amastris funkhouserii.
- (48, 49) 50. Pronotum not compresso-elevate, but convex, tectiform, though scarcely keeled.
- (52) 51. Ground colour black or brown, variegated with white or yellow.
 a. Large, hairy, with a transverse yellow dorsal band
Boethoos cinctata.
 b. Smaller than the last, and with a lateral yellow spot or streak
Boethoos distinguenda.
 c. Black, variegated with white.....*Boethoos reticulata*.
 d. Brown, with the dorsum depressed behind the middle
Boethoos globosa.
- (51) 52. Ground colour green, or sordid white.
 a. Hairy, and broadly marked across the dorsum with chestnut
Vanduzea testudinea.
 b. Very small: colour green or sometimes brown..*Aphetea affinis*.
- (1) 53. Posterior tarsi much shorter than the other pairs (Holophorinae).
- (55) 54. Wing with four apical cells: horn projecting forwards: colour brown
Aconophoroides gladiator.
- (54) 55. Wing with three apical cells: horn situated on the middle of dorsum: colour green.....*Umbonia spinosa*.
- B. Scutellum distinct, and more or less uncovered by the pronotum.
- (13) 1. Either or both the pronotum and scutellum armed with processes, crests, or carinae.
- (3) 2. Pronotum armed with a posterior process; scutellum unarmed.
 a. Posterior process of the pronotum lying close to the abdomen and extending almost to the apex of the latter: a pair of broad lateral processes above the shoulders
Centruchooides felinus.
 b. Posterior process long and styliform, remote from abdomen, and springing above the head from an erect process, which

is furnished in front with four black petiolated swellings.

Bocydium globulare.

- c. Posterior process short and spike-like, and hardly reaching half way along the abdomen. Size small: hind tibiae long, black, curved, and covered with minute regular spines

Ischnocentrus niger.

- (2) 3. Pronotum without a posterior process: scutellum unarmed.
- (5) 4. Pronotum armed with two lateral processes in front: scutellum pale
Tolania scutata.
- (4) 5. Pronotum without lateral processes.
- (7, 12) 6. Either or both the pronotum and scutellum provided with a pronounced median carina or crest. The hind tibiae long, curved and furnished with numerous minute spines.
(Lophyraspis, Tropidaspis.)
- (6, 12) 7. With a crest or crests.
- (11) 8. Both pronotum and scutellum crested.
- (10) 9. The crests sharp, high, recurved and bordered behind with white.
a. The two crests of equal height *Lophyraspis armata.*
b. The crest of the pronotum highest: size smaller
Lophyraspis pygmaea.
- (9) 10. The pronotal crests rounded and inclined forwards: not bordered with white behind: scutellum not crested but strongly carinate
Tropidaspis cornuta.
- (8) 11. The scutellum alone furnished with a crest, which is erect, compressed, and bordered with white behind. . . *Lophyraspis fowleri.*
- (6) (7) 12. Pronotum and scutellum not crested but carinate.
a. Upper margin of the head sinuate. *Tropidaspis carinata.*
b. Upper margin of the head bi-lobed: size smaller
Tropidaspis minor.
- (1) 13. Pronotum and scutellum either completely unarmed, or at most faintly carinate.
a. Size rather large and square: colour brown: venation thickened and reticulate: legs without spines, and yellow, conspicuously spotted with black: upper margin of head almost flat. *Aethalion reticulatum.*
b. Size very small and elongate: colour bronze black: tegmina opaque, but venation not reticulate: upper margin of head produced into two narrow lobes. . . *Endoiastus productus.*